LAND INFORMATION SYSTEM, PART OF ASA-DAM CO0MMUNITY AREA, ILORIN, KWARA STATE.

SUBMITTED TO THE DEPARTMENT OF SURVEYING AND GEOINFORMATICS

IN PARTIAL FULFILMENT OF THE REQUIREMENTSFOR THEAWARD OF HIGHER NATIONAL DIPLOMA

IN

SURVEYING AND GEOINFORMATICS

SUBMITTED BY ADEBOWALE MARY PROMISE

MATRICULATION NUMBER: HND/23/SGI/FT/0011

CERTIFICATE

I **ADEBOWALE MARY PROMISE** with Matriculation number, **HND/23/SGI/FT/0011** hereby certify that all the information contained in this project report were obtained by me as a result of observations and measurements made by me on the field and that the survey was done in accordance with survey rules, regulations, and departmental instructions.

Signature of Student: …………………………...

Name of Student: ADEBOWALE MARY PROMISE

Matriculation number: - HND/23/SGI/FT/0011

Date of Completion…………………..…

CERTIFICATION

This is to certify that **ADEBOWALE MARY PROMISE** with Matriculation number **HND/23/SGI/FT/0011** has satisfactorily carried out this project under our instructions and direct supervision.

We hereby declared that he has conducted himself with due diligence, honesty and sobriety on this project.

Supervisor's Signature: ……………….…………..

Name of Supervisor: SURV. ROTIMI ASONIBARE

Date: ………………..…………….

Project coordinator's Signature: ……………….…………..

Name of Project coordinator: SURV. R.S. AWOLEYE

Date: ………………..…………….

Head of Department's Signature: ……………….…………..

Name of Head of Department: SURV. ABIMBOLA

Date: ………………..……………

External Moderator's Signature: ……………….…………..

Date: ………………..…………….

DEDICATION

This project is dedicated to Almighty God, the magnificient, the over merciful to my lovely parents for their supports towards the successful completion of this program.

ACKNOWLEDGEMENTS

My sincere appreciation goes to Almighty God, for giving me the grace and opportunity to compile this project report. I give glory, honor and adoration to Almighty God, who is the alpha and the omega, the author and the finisher of my faith; who had made me to endure the vigor of my study. So, I return all glory back to Him.

I express my profound and unreserved gratitude to my able project supervisors**; SURV ROTIMI ASONIBARE, SURV ABIMBOLA, SURV A. G AREMU, SURV AWOLEYE, SURV AYUBA, SURV BANJI, SURV KABIR** and **SURV DIRAN.** for his wonderful advice and guidance, accurate criticism and attentiveness together with solution they proffered to the challenges I faced during the course which have contributed to the successful completion of this project. I pray that Almighty God will continue to bless him and his family, his wisdom, knowledge and understanding shall never seize and he shall succeed in everything they laid his hands on (Amen).

Specially, I wish to acknowledge the efforts of my lovely and caring mother, **MRS. JANET ADEBOWALE** for her support both financially and morally, her love, kindness and generosity towards me throughout the execution of this project task. I pray that Almighty God reward her abundantly.

Lastly, I would like to acknowledge my indebtedness to all my friends; Kenny, Aisha, Grace, Ayomide, my senior colleagues, my wonderful group members who impacted one knowledge or the other during the execution of this project and also made this project a reality I love you all. May Almighty God increase you in knowledge and understanding (Amen)

ADEBOWALE MARY PROMISE

JULY, 2025

ABSTRACT

This study presents the development and implementation of a Land Information System (LIS) for the Asa-Dam Community Area in Ilorin, Kwara State, Nigeria. The project addresses the challenges of fragmented land records, inefficient land management, and limited access to reliable spatial data, which have historically hindered urban planning and sustainable development in the region. A comprehensive methodology was employed, combining field surveys using Total Station equipment, the integration of historical maps and satellite imagery, and the creation of a multi-layered geospatial database using AutoCAD and ArcGIS software. The LIS was designed to store and manage both geometric and attribute data, enabling advanced spatial queries for land use assessment, zoning compliance, and resource allocation. Despite encountering technical challenges such as data fragmentation, software interoperability issues, limited attribute detail, and infrastructure constraints, the system demonstrated significant potential in improving land administration, reducing disputes, and supporting informed decision-making. The study concludes that continuous data refinement, stakeholder engagement, and investment in technical infrastructure are essential for maximizing the LIS's impact. Recommendations include enhancing data quality, expanding internet access, implementing robust security protocols, and promoting community awareness to ensure the system's sustainability and scalability for broader application in similar urban and rural contexts.

TABLE OF CONTENTS **PAGES**

LIST OF TABLES

LIST OF FIGURES

CHAPTER ONE

INTRODUCTION

Background to The Study

Land use information plays a pivotal role in understanding the dynamics between human activities, environmental processes, and land management practices. Land use refers to the ways in which human societies utilize the land, shaping it for various purposes such as agricultural production, urban development, industrial activities, and conservation (Miller et al., 2019). It is a concept that encapsulates not only the physical changes made to land surfaces but also the broader socio-economic and environmental implications of those changes. Accurate and up-to-date land use data are crucial for effective governance, sustainable development, environmental protection, and climat1e resilience. With increasing population pressures, shifting patterns of consumption, and ongoing environmental degradation, there is an urgent need to monitor, manage, and plan land use at both global and local scales.

Globally, land use is undergoing rapid transformation as human populations expand and as new technologies, industries, and infrastructure reshape urban and rural landscapes. According to the United Nations (2019), the world's population is expected to grow to nearly 10 billion by 2050, with significant implications for land use. The spread of urban areas, intensified agricultural production, and the conversion of natural ecosystems for development are all expected to escalate. These changes not only affect biodiversity, carbon cycles, and water resources but also have significant implications for food security, housing, and transportation systems (Seto et al., 2011). As such, land use information has emerged as a critical tool for managing these transformations and minimizing their negative impacts on the environment and society.

Technological advancements over the last few decades have revolutionized the collection and analysis of land use data. Remote sensing technologies, including satellites and drones, allow for the monitoring of large-scale land use changes with high precision, enabling the detection of deforestation, urban sprawl, land degradation, and agricultural expansion (Goodchild, 2020). Geographic Information Systems (GIS) have further enhanced land use studies by providing spatial tools for analyzing patterns, trends, and the relationships between various land use types. For instance, GIS allows for the creation of land use maps that represent not just the current state of the land but also historical changes and predictions for future land use patterns (Miller et al., 2019). The integration of machine learning and artificial intelligence

(AI) with geospatial technologies has made it possible to analyze large datasets, identify trends, and develop predictive models that support more informed decision-making.

The use of GIS and remote sensing has expanded significantly in the fields of urban planning, agriculture, environmental management, and disaster response. For example, urban planners use land use data to optimize transportation systems, reduce pollution, and plan for green spaces, while environmental scientists rely on it to assess ecosystem health, identify areas at risk of degradation, and develop conservation strategies (Goodchild, 2020). The ability to map land use change in near real-time also facilitates emergency responses to natural disasters, allowing authorities to assess damage and direct resources efficiently.

Historically, land use studies have provided a foundation for understanding the interactions between human activities and the environment. In the pre-industrial era, land was primarily used for subsistence agriculture, and the concept of land use was relatively simple. However, with the industrial revolution came rapid urbanization and the expansion of agricultural practices, which began transforming landscapes at an unprecedented scale. These transformations continue to have profound effects on ecosystems and climate patterns. For instance, widespread deforestation for agriculture and timber has led to biodiversity loss and disruption of carbon sequestration processes, contributing to climate change (Foley et al., 2005). Similarly, urbanization has resulted in the creation of heat islands, altered water cycles, and increased pressure on natural resources. Understanding these long-term patterns and their implications is critical for addressing the challenges associated with land use today.

Urban sprawl, in particular, has become one of the most visible and problematic forms of land use change in the modern era. The expansion of cities into surrounding rural areas often results in the loss of agricultural land, forests, wetlands, and other critical ecosystems. Urban sprawl has been linked to increased traffic congestion, air pollution, reduced biodiversity, and a host of social and economic challenges, such as inequality in access to housing and services (Seto et al., 2011). Effective land use planning and zoning laws are essential to managing urban growth in a way that minimizes negative outcomes while promoting sustainable development. Moreover, there is growing recognition that the preservation of green spaces within urban environments is crucial for enhancing quality of life, providing ecosystem services, and fostering climate adaptation.

In addition to urban expansion, another pressing issue is the growing demand for agricultural land. Agricultural expansion, driven by the need to feed a growing global population, is often cited as a major driver of deforestation and environmental degradation, especially in developing regions. Shifting cultivation, unsustainable farming practices, and the clearance of forests for large-scale agriculture have led to the loss of critical habitats and a decline in soil fertility (Foley et al., 2005). Sustainable agriculture, which balances food production with environmental stewardship, is a key focus of modern land use planning. Practices such as agroforestry, crop rotation, and organic farming aim to reduce the environmental footprint of agriculture while maintaining productivity.

The importance of accurate land use data is underscored by its role in addressing global environmental and sustainability challenges. Land use change is a major contributor to greenhouse gas emissions, with land conversion accounting for nearly one-quarter of global emissions (United Nations, 2015). Conversely, the restoration of degraded lands, afforestation, and reforestation efforts can mitigate these emissions and help sequester carbon, contributing to climate change mitigation. In urban contexts, land use planning is crucial for enhancing resilience to climate change by incorporating green infrastructure, sustainable transport, and energy-efficient buildings into urban designs. By prioritizing sustainability in land use decisions, countries can contribute to the achievement of the United Nations Sustainable Development Goals (SDGs), particularly those related to climate action (Goal 13), sustainable cities and communities (Goal 11), and life on land (Goal 15).

In addition to global initiatives, local land use data is also vital for addressing regional and community-level challenges. For instance, in many developing countries, poor land management has contributed to desertification, deforestation, and the depletion of water resources. Limited access to accurate land use data exacerbates these issues, as policymakers and local governments lack the tools to assess land potential and make informed decisions. By improving land use information systems, these regions can develop more effective strategies for resource management, conservation, and sustainable development.

This study seeks to explore the significance of land use information in promoting sustainable development, ensuring environmental protection, and supporting informed decision-making across various sectors. By examining the technologies and methods used to collect and analyze land use data, this research will contribute to a deeper understanding of land use dynamics and their implications for society. Moreover, the study aims to provide actionable recommendations for improving land use data collection, enhancing land use planning, and ensuring more effective management of land resources in the face of growing global challenges.

1.2 Statement of the Problem

The lack of a comprehensive land use information system in Asa-Dam Community Area, Kwara State, Nigeria, has posed significant challenges in effective land management, planning, and decision-making. Land resources in the area are underutilized due to inadequate data collection and the absence of a centralized platform for accessing accurate land use information. This has resulted in disputes over land ownership, inefficient allocation of land for agricultural and residential purposes, and challenges in urban development planning.

1.3 Aim and Objectives

Aim:

The aim of this project is to develop a functional land use information system for Asa-Dam Community Area in Kwara State, Nigeria, to enhance land management and planning processes.

Objectives:

1. To design and implement a centralized database that stored detailed information on land use patterns, ownership, and zoning regulations.

2. To integrate geospatial data to enable visual representation and analysis of land use information.

3. To develop user-friendly interfaces that allowed stakeholders, including government agencies, urban planners, and the public, to access and interact with the system efficiently.

4. To ensure the system supported sustainable land development by providing tools for assessing land suitability and monitoring changes in land use over time.

1.4 Scope of the Project

The project encompassed the development of a Land Use Information System tailored to the specific needs of the target region. It involved the collection and integration of various data types, including cadastral data, satellite imagery, and existing land records. The system was designed to support functionalities such as land use mapping, querying, reporting, and analysis. Additionally, provisions were made for future scalability to accommodate expanding datasets and the integration of additional modules, such as environmental impact assessments and real-time data updates.

1.5 Specification of the Project

1. Database Design: A relational database was structured to store comprehensive land use data, ensuring data integrity and facilitating efficient retrieval.

2. Geospatial Integration: Geographic Information System (GIS) technology was employed to enable spatial analysis and visualization of land use patterns.

3. User Interface: Intuitive web-based interfaces were developed to allow users to perform tasks such as searching for land parcels, viewing zoning information, and generating reports.

4. Data Security: Measures were implemented to protect sensitive information, including user authentication protocols and data encryption.

5. Sustainability Tools: Analytical tools were incorporated to assess land suitability for various uses, promoting sustainable development practices.

6. Documentation and Training: Comprehensive user manuals and training sessions were provided to ensure effective utilization of the system by all stakeholders.

By addressing these specifications, the project successfully delivered a robust Land Use Information System that enhanced the efficiency and effectiveness of land management and planning processes.

1.7 Personnel

The under listed names are those that were directly involved in the execution of the project both on the field and in the office.

S/N	MATRIC NO	ROLE
1.	HND/23/SGI/FT/0011	Author
2.	HND/23/SGI/FT/0006	Member
3.	HND/23/SGI/FT/0007	Member
4.	HND/23/SGI/FT/0009	Member
5.	HND/23/SGI/FT/0013	Member
6.	HND/23/SGI/FT/0012	Member
7.	HND/23/SGI/FT/0014	Member

Study Area

The location of project area is Asa-Dam Community Area, Ilorin, kwara State. It is located in Zone 31 of the Universal Transverse Mercator (UTM) system between longitude 4^{o} 55’ E and latitude of 8^{o} 48’ N in the north central geopolitical zone of Nigeria.

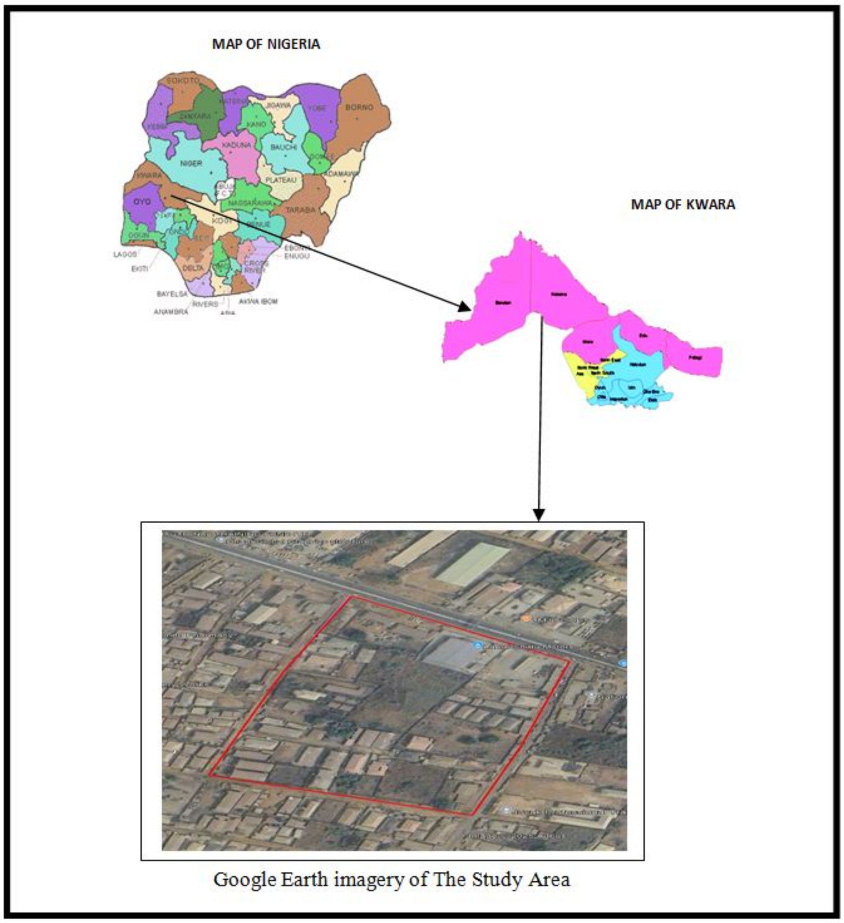


Figure 1.1 showing the map of the study area.

CHAPTER TWO

LITERATURE REVIEW

A Land Information System (LIS) is an advanced technological framework designed to systematically collect, manage, analyze, and disseminate land-related data to facilitate informed decision-making. LIS integrates diverse datasets such as cadastral, topographical, legal, and administrative information to enhance land governance, improve land-use planning, and streamline property rights management.

The significance of LIS has grown due to rapid technological advancements, including Geographic Information Systems (GIS), remote sensing, cloud computing, and blockchain technology, which have revolutionized the way spatial data is captured, stored, and accessed. These innovations have improved efficiency, transparency, and accessibility in land administration by enabling real-time data processing and enhancing interoperability across different sectors. LIS plays a crucial role in land tenure security, urban planning, environmental management, and disaster mitigation. By providing accurate and up-to-date land records, LIS supports policymakers, surveyors, urban planners, and government agencies in making well-informed decisions regarding land use and property management. The widespread adoption of LIS has facilitated better spatial data analysis, property valuation, and sustainable resource management.

This literature review delves into the theoretical foundations, historical evolution, core components, challenges, and diverse applications of LIS. By analyzing existing research and technological advancements, this study aims to provide a comprehensive understanding of how LIS contributes to effective land administration and management.

The foundation of LIS is based on land administration and spatial data management. LIS primarily handles spatially referenced land data to enhance land tenure, valuation, usage, and development planning. It provides a structured framework for integrating diverse land-related datasets, thereby ensuring accurate and efficient land management. Dale and McLaughlin (2010) emphasize that LIS plays a critical role in land administration theories, including land tenure, land use planning, and property valuation frameworks.

Longley et al. (2015) highlight the role of geospatial science in enhancing LIS functionality, with GIS and remote sensing playing a significant role in capturing, analyzing, and visualizing spatial data. The ability to overlay multiple layers of geographic information enables LIS to provide in-depth insights into land ownership patterns, land-use changes, and environmental management. Moreover, advancements in GIS applications have improved spatial decision-making by integrating real-time and historical land data.

Furthermore, LIS incorporates robust database management systems that store, retrieve, and update spatial and non-spatial land records. These databases are structured within Spatial Data Infrastructure (SDI) frameworks, which facilitate seamless data exchange across government agencies, private sectors, and land stakeholders (Ting & Williamson, 2011). By promoting interoperability, SDI enhances the efficiency of land administration services such as land registration, land-use planning, and property taxation.

Additionally, legal frameworks such as land registration systems, tenure policies, and property laws are essential components of LIS development. Properly established land registration systems ensure that land ownership rights are secure, reducing disputes and fraud. Land laws, on the other hand, provide the legal foundation for LIS implementation, guiding land-use regulations, zoning ordinances, and environmental compliance.

Moreover, the integration of cloud computing has revolutionized LIS by enabling remote access to land records and geospatial data. Cloud-based LIS platforms facilitate data sharing among stakeholders in real time, reducing redundancies and improving service delivery. The ability to leverage big data analytics within LIS further enhances predictive modeling, land value assessment, and strategic urban planning.

LIS has undergone significant transformations, transitioning from manual record-keeping to digitalized and cloud-based systems. Historically, land records were maintained manually in registers and paper maps, leading to inefficiencies such as data loss, redundancy, and lack of accessibility. These traditional systems were prone to errors and corruption, hindering effective land administration and governance.

The introduction of Geographic Information Systems (GIS) in the 1980s and 1990s marked a revolutionary shift in LIS. GIS enabled spatial data integration, making it easier to analyze and visualize land-related information (Burrough, 2010). This technological advancement allowed governments and institutions to create digital cadastral maps, improving accuracy in land records and enabling better land-use planning. With GIS, users could overlay different layers of spatial data, facilitating comprehensive analysis of land distribution and ownership patterns.

In the 21st century, LIS further evolved with the advent of web-based and cloud computing platforms. Cloud-based LIS systems allow real-time access to land records from anywhere, improving efficiency and reducing administrative burdens (Rajabifard et al., 2012). These platforms also enhance interoperability by allowing multiple stakeholders, such as government agencies, private sectors, and the public, to access and update land data seamlessly. The integration of mobile applications into LIS has made it easier for surveyors and land administrators to collect and update land information on-site, ensuring data accuracy and timeliness.

More recently, blockchain technology has emerged as a transformative force in LIS. Blockchain offers a decentralized and tamper-proof method of recording land transactions, significantly increasing security and transparency (Zhu & Wang, 2020). By eliminating the need for intermediaries in land transactions, blockchain reduces fraud and disputes, ensuring a more reliable and trustworthy land administration system. Additionally, smart contracts within blockchain-powered LIS can automate property transfers, reducing processing time and administrative costs.

Another significant advancement in LIS is the use of remote sensing and drone technology for land surveying. High-resolution satellite imagery and drone-based mapping provide accurate and up-to-date land cover data, which is essential for monitoring land use changes, urban expansion, and environmental degradation. These technologies contribute to more efficient land administration by reducing the time and cost associated with traditional surveying methods.

As LIS continues to evolve, governments and institutions must focus on policies that support technological adoption, capacity building, and data standardization. Addressing challenges such as digital divide, cybersecurity risks, and data privacy concerns is essential for maximizing the benefits of modern LIS. The future of LIS lies in the integration of emerging technologies to create intelligent, automated, and highly secure land administration systems that promote sustainable land management and economic development.

A modern Land Information System (LIS) is composed of multiple essential components that collectively enhance its efficiency and functionality:

Spatial Data Infrastructure (SDI): This component encompasses geospatial datasets, including cadastral maps, satellite imagery, and topographical data. SDI facilitates the integration and sharing of spatial information across various governmental and private entities, ensuring accuracy and accessibility.

Land Tenure System: The land tenure system defines property ownership rights, registration mechanisms, and tenure security. It plays a crucial role in maintaining legal records of landownership and resolving disputes related to land claims.

Database Management Systems (DBMS): DBMS provides a structured and centralized repository for storing land records, metadata, and transaction histories. Modern LIS employs relational and spatial databases to ensure data integrity, consistency, and efficient retrieval.

Legal and Institutional Frameworks: The effectiveness of an LIS depends on well-defined legal and institutional frameworks that govern land administration. These frameworks establish land registration policies, dispute resolution mechanisms, and guidelines for sustainable land management.

Technical Infrastructure: LIS relies on a combination of hardware, software, and network technologies. This includes GIS software, cloud-based platforms, and secure data storage systems that support real-time data processing and interoperability among various land administration agencies.

User Interfaces and Applications: Web-based portals and mobile applications enhance accessibility and usability of LIS. These interfaces allow landowners, government officials, surveyors, and other stakeholders to interact with the system, access relevant land records, and perform transactions efficiently.

Each of these components plays a vital role in ensuring that an LIS operates effectively, providing reliable data and facilitating transparent land management practices.

Land Information Systems (LIS) have significantly transformed how land data is managed, providing governments, businesses, and communities with an essential framework for managing land resources efficiently. As technology advances, LIS has grown increasingly sophisticated and integral in land administration processes. However, despite its clear advantages, the implementation and operation of LIS face several persistent challenges. From data quality issues inherited from legacy systems to institutional barriers, high costs, and cybersecurity risks, these hurdles must be addressed for LIS to realize its full potential. This discussion elaborates on these challenges, drawing on perspectives from various scholars and experts, including Williamson et al. (2012), Dale and McLaughlin (2011), Enemark (2014), and Zhu and Wang (2020).

One of the significant challenges in implementing LIS is the poor-quality data inherited from legacy systems. As noted by Williamson et al. (2012), many countries' land administration systems rely on outdated technologies that are not only inefficient but also prone to inaccuracies. These legacy systems often store land records in physical forms, which are susceptible to degradation, loss, or corruption. Over time, this results in incomplete or outdated land information that, when transferred into digital LIS platforms, may lead to errors and discrepancies.

Moreover, land data from older systems might not adhere to modern standards of data accuracy, consistency, or compatibility. For instance, historical data may not be in a format suitable for contemporary digital systems, requiring extensive data cleaning and transformation. This process can be costly and time-consuming, diverting resources away from other essential aspects of LIS implementation, such as system design and user training.

Poor-quality data can also have cascading effects on land administration processes. For example, inaccurate land boundaries or outdated ownership records can lead to disputes, delays in property transactions, and legal challenges. The inability to trust the data can erode the credibility of the system, discouraging stakeholders from fully adopting LIS.

Institutional and legal barriers represent another major challenge in the implementation of LIS. Dale and McLaughlin (2011) highlight that many countries have fragmented land administration frameworks, where multiple institutions or agencies manage different aspects of land records. In many cases, there may be overlapping responsibilities or a lack of coordination among these entities, making it difficult to establish a unified system for managing land data.

For example, cadastral offices, land registries, planning departments, and environmental agencies may each maintain their own separate datasets, without sufficient integration between them. This lack of coordination leads to inefficiencies, redundancies, and inconsistencies in the data. It can also result in delays when land-related information needs to be shared across departments, impacting decision-making processes.

In addition to institutional fragmentation, legal frameworks that govern land ownership and land transactions may be outdated or incompatible with modern digital systems. In some regions, land laws may not recognize electronic or digital records, which makes the transition to LIS difficult. Even when digital systems are implemented, there may be legal challenges regarding the validity of electronic signatures, the ownership of digital data, or the enforceability of contracts made using digital land records. Overcoming these institutional and legal barriers requires significant reform efforts, including aligning land laws with technological advancements and fostering collaboration between different land administration agencies.

The high implementation costs of LIS are another significant challenge. Enemark (2014) emphasizes that establishing a comprehensive, modern land information system requires significant financial investment. The development of such a system involves various stages, including the collection and digitization of data, software and hardware procurement, infrastructure development, and system maintenance. These activities require not only capital but also long-term funding commitments to ensure the system's sustainability.

One of the most expensive components of implementing LIS is the data collection process. In many cases, land data is incomplete, inconsistent, or inaccurate, requiring substantial efforts to update and validate it. This process can include conducting surveys, updating cadastral records, and obtaining information from various stakeholders. In low- and middle-income countries, these costs can be particularly burdensome, as they may lack the financial resources to fully digitize and maintain land records.

In addition to direct implementation costs, there are ongoing expenses associated with LIS maintenance. These include system updates, data storage, and personnel costs for managing the system. As technology evolves, LIS must continually adapt to ensure it remains relevant and effective. Given these substantial costs, some countries may find it difficult to justify the investment in LIS, especially if they face competing priorities or limited budgets.

The high costs of LIS development can also lead to reliance on donor funding, which may introduce external pressures or influence in how land information systems are designed and operated. In some cases, donor-funded projects may prioritize short-term goals over long-term sustainability, leading to incomplete systems or insufficient capacity for ongoing maintenance.

The implementation and management of LIS require skilled personnel, including system administrators, GIS experts, data analysts, and land surveyors. A shortage of trained professionals is a common challenge, especially in developing countries. The lack of skilled personnel not only hinders the effective management of LIS but also limits the system's capacity to update land records and ensure data quality.

Lack of training and expertise can lead to errors in data entry, mismanagement of land information, and poor decision-making. Furthermore, as LIS systems become more advanced, the need for specialized knowledge in areas such as GIS, machine learning, blockchain, and data security increases. Without adequate personnel, the effectiveness of the system may be compromised, and the system's potential benefits may not be fully realized.

Training personnel to manage and operate LIS is a time-consuming process that requires significant investment in education and capacity building. Moreover, governments may struggle to retain skilled staff due to low salaries, poor working conditions, or competition from the private sector. As a result, LIS implementation is often slowed down, as inadequate staff levels can lead to operational inefficiencies and delays in updating land records.

As land information systems become increasingly digitalized, cybersecurity and privacy concerns become paramount. Zhu and Wang (2020) discuss how LIS is vulnerable to cyber threats, such as hacking, data breaches, and unauthorized access. Since land records contain sensitive personal and financial information, ensuring their security is essential to maintaining trust in the system.

Cybersecurity risks pose a particular challenge as more land data is stored online or in cloud-based systems. These systems may be exposed to various threats, including malicious attacks, data corruption, and loss of data integrity. A successful cyberattack could lead to the loss of critical land data, unauthorized changes to land records, or even identity theft. The consequences of such breaches can be severe, ranging from financial losses to legal disputes.

Privacy risks are also a concern, as digital land records may contain private information about landowners, property transactions, and other sensitive data. Ensuring that this information is protected from unauthorized access and misuse requires the implementation of robust encryption, authentication, and data access controls. Governments and organizations must adopt stringent data protection regulations to safeguard privacy while balancing transparency and accessibility.

As technology advances, it becomes increasingly difficult to predict and mitigate cybersecurity risks. Ensuring the continued security of LIS will require constant monitoring, regular system updates, and ongoing investment in cybersecurity infrastructure.

Resistance to change is a common challenge in the transition from traditional land administration systems to digital platforms. Many stakeholders, including government officials, land surveyors, and the general public, may be reluctant to adopt new technologies due to unfamiliarity, fear of job displacement, or concerns over the reliability of digital systems.

For instance, land professionals who have worked with paper-based systems for years may be hesitant to switch to digital systems due to concerns about the learning curve, the potential for system failures, or the loss of traditional practices. Additionally, landowners and the general public may be skeptical about the security and accuracy of digital land records, particularly in regions with low levels of digital literacy.

Overcoming this resistance requires proactive change management strategies. Governments and institutions must engage stakeholders early in the process, educating them about the benefits of LIS and addressing concerns about data privacy and system reliability. Providing training programs, offering technical support, and demonstrating the long-term advantages of digital land systems can help foster acceptance and build trust.

Land Information Systems (LIS) have become a cornerstone for managing land-related data across multiple sectors, facilitating improved decision-making, enhancing efficiency, and promoting sustainable development. By digitizing and centralizing land-related information, LIS supports various industries ranging from land administration and urban planning to environmental management, agriculture, disaster management, and real estate. Below is an exploration of how LIS benefits these sectors, enhancing the efficiency of operations and decision-making processes.

LIS plays a vital role in land administration and management, particularly in land registration, cadastral mapping, and ensuring tenure security. According to Williamson et al. (2012), a well-implemented LIS provides a central database for storing and managing land ownership records, which is essential for ensuring the security of land tenure. Land tenure security is critical because it protects property rights, encourages investment, and reduces conflicts over land ownership.

LIS supports land registration by providing a digital platform for recording ownership, boundaries, and legal titles, which helps streamline property transactions. Through cadastral mapping, land survey data are digitized and integrated into the LIS, allowing for accurate, real-time updates to land records. This reduces errors and fraud, promotes transparency, and simplifies the land transaction process. A digital approach to land administration is also more efficient and reduces costs compared to traditional paper-based systems.

By centralizing land data, LIS enhances the ability of governments and land administration authorities to monitor land ownership patterns, resolve disputes, and enforce property laws. As a result, the system promotes transparency and public trust in land administration, contributing to more effective governance.

In urban planning and development, LIS is used to manage zoning, infrastructure development, and land-use planning. According to Longley et al. (2015), urban planners rely on LIS to analyze spatial data, identify patterns in land use, and plan future urban developments. This information is critical for determining the best locations for housing, commercial centers, schools, and other infrastructure projects, ensuring that urban growth is well-coordinated and sustainable.

LIS aids in the creation of zoning maps, which define land-use categories such as residential, commercial, industrial, and recreational. These zoning regulations help to ensure that land is used efficiently and in accordance with the city's development goals. By integrating GIS (Geographic Information Systems) with LIS, urban planners can visualize and assess land suitability for different uses, such as identifying areas at risk of flooding, managing green spaces, or planning for transportation networks.

Additionally, LIS helps monitor and manage land-use changes over time, providing insights into urban sprawl and enabling timely intervention when needed. In rapidly growing urban areas, the data provided by LIS helps planners make informed decisions to prevent the chaotic expansion of cities, ensuring that resources are allocated effectively.

LIS is also essential in environmental management, where it helps monitor natural resources, land degradation, and the impacts of climate change. Rajabifard et al. (2013) explain that LIS is used to track deforestation, assess flood risks, and model the effects of climate change on land areas. By providing access to spatial data on environmental variables such as land cover, vegetation, and soil types, LIS enables environmental managers to make informed decisions about conservation, land restoration, and sustainable resource use.

For example, deforestation can be monitored by analyzing satellite imagery and mapping changes in forest cover over time. This information is critical for countries aiming to meet climate change mitigation goals, as it supports efforts to reduce emissions from land-use changes. In flood management, LIS allows for the identification of flood-prone areas, helping to design effective flood control infrastructure and disaster preparedness plans.

LIS is also used in climate change adaptation by providing data to support land use planning and the identification of vulnerable regions. For instance, areas that are more susceptible to droughts or rising sea levels can be prioritized for adaptation measures such as afforestation, coastal protection, or land use restrictions.

In agriculture and rural development, LIS supports land suitability analysis, irrigation planning, and soil management. Enemark (2014) highlights that LIS is instrumental in assessing the suitability of land for different crops, optimizing agricultural productivity, and promoting sustainable farming practices. By analyzing soil types, topography, and climate conditions, farmers can make informed decisions about which crops are most suitable for their land, leading to better yields and more efficient land use.

LIS also plays a crucial role in irrigation planning. By mapping water resources and analyzing water availability, LIS helps design efficient irrigation systems, reducing water waste and improving crop production. In regions where water is scarce, the ability to track and manage water resources is essential for sustainable agriculture. Moreover, LIS can assist in soil management by identifying areas at risk of erosion, degradation, or salinization, enabling farmers and policymakers to take corrective action before these issues become critical.

For rural development, LIS facilitates the management of land tenure and rural land-use patterns, supporting land reforms and ensuring that rural communities have secure access to land. This, in turn, promotes economic development and poverty reduction in rural areas.

LIS is an essential tool in disaster management, helping governments and organizations assess risks, plan for emergencies, and respond to natural disasters. Zhu and Wang (2020) emphasize the role of LIS in risk assessment and emergency response planning. By integrating spatial data from various sources, including historical disaster records, weather patterns, and topography, LIS can help identify disaster-prone areas such as flood zones, earthquake fault lines, or wildfire hotspots.

In disaster response, LIS enables authorities to quickly assess the extent of damage and identify areas in need of immediate assistance. For example, following a natural disaster, LIS can be used to determine which regions have the greatest need for humanitarian aid, infrastructure repair, or evacuation efforts. This improves the coordination of response activities, ensuring that resources are directed to where they are most needed.

Additionally, LIS supports long-term disaster risk reduction by identifying vulnerable communities and areas where mitigation measures, such as flood barriers or building retrofits, are necessary. By facilitating better disaster preparedness and response planning, LIS contributes to reducing the impact of natural disasters and enhancing resilience.

In the real estate sector, LIS enhances property valuation, taxation, and land market analysis. Dale and McLaughlin (2011) note that LIS provides accurate, up-to-date information about land ownership, property boundaries, and land use, which is essential for valuing properties correctly. Property valuers, real estate agents, and tax authorities rely on this information to assess the market value of land and buildings, helping to ensure that property taxes are fairly distributed and that land markets operate efficiently.

LIS enables detailed analysis of property prices, market trends, and factors influencing land values, such as proximity to amenities, infrastructure quality, and land-use zoning. This information is crucial for investors, buyers, and sellers when making informed decisions. Furthermore, by automating property valuation processes, LIS can reduce errors and streamline land appraisal, making transactions faster and more accurate.

The integration of LIS with real estate databases also enhances land market analysis by providing insights into trends and patterns in property transactions. This is particularly valuable for governments and financial institutions that need to monitor and regulate the real estate market.

The evolution of Land Information Systems (LIS) has been continuously influenced by technological advances and policy developments. With emerging technologies such as Artificial Intelligence (AI), machine learning, blockchain, Augmented Reality (AR), 3D Geographic Information Systems (GIS), and cloud computing, LIS has transformed into a more robust, efficient, and user-friendly platform. These technologies have not only enhanced data analytics but also opened doors for improved land management, planning, and policy implementation, while promoting transparency, security, and community participation. This transformation has reshaped the way land-related information is handled and its subsequent impacts on land administration globally.

Blockchain has introduced a game-changing solution for land record security. This decentralized ledger technology ensures that land data, such as ownership records, property transfers, and legal documentation, are stored in a tamper-proof and transparent manner (Zhu & Wang, 2020). The ability to securely store and access land records provides greater confidence in land transactions, reduces the risk of fraud, and prevents disputes over land ownership.

A key benefit of blockchain in LIS is its ability to streamline property transfer processes by eliminating the need for intermediaries like notaries or lawyers. This reduces transaction costs and enhances transparency. With blockchain, each transaction is recorded in a block and is time-stamped, ensuring the integrity of land data over time. Governments and private organizations benefit from the system's ability to maintain an immutable record, which enhances accountability and reduces corruption in land administration.

Augmented Reality (AR) and 3D Geographic Information Systems (GIS) are pivotal in modern land planning and development. These technologies provide an immersive environment that allows stakeholders to visualize land data in a more interactive manner. AR overlays digital information on the real-world landscape, enabling users to view land features, infrastructure, and potential developments in real-time. This visualization helps planners, architects, and local communities better understand the implications of land-use changes.

3D GIS further enhances the accuracy of spatial data by representing terrain, elevation, and land use in three dimensions, offering more precise analyses. These technologies are especially useful in urban planning, where multiple layers of information, such as transportation networks, zoning laws, and population density, need to be analyzed in conjunction with each other. With the combination of AR and 3D GIS, stakeholders can simulate various scenarios, such as new construction projects, to assess their environmental, social, and economic impacts.

The rise of open data initiatives has played a significant role in the development of more inclusive and accessible Land Information Systems. By making land data available to the public, governments and organizations encourage greater transparency and participation in land management processes. Open data initiatives empower citizens, businesses, and researchers to use land-related data for various purposes, such as environmental monitoring, disaster response, and urban planning.

Crowdsourced mapping, where local communities contribute data about land boundaries, infrastructure, and resources, further democratizes land information. In regions where land records may be incomplete or outdated, crowdsourcing can fill critical data gaps, ensuring that the most accurate and up-to-date information is available. This also fosters community involvement and engagement, as people become active participants in the mapping process. Crowdsourced data often complements official land records and can be integrated into national or regional databases to improve the quality and accuracy of land information systems.

Cloud computing has revolutionized the management of land data by providing scalable, flexible, and cost-effective solutions for storing and sharing land information. Cloud-based Land Information Systems allow for the centralized management of data that can be accessed and updated in real-time from anywhere with an internet connection. This is particularly important for governments and organizations managing large-scale land data across multiple regions.

The work aims to highlight how migrating the Land Information System (LIS) to the cloud enables real-time access to land data, fostering efficient collaboration among stakeholders from different sectors. It emphasizes that cloud computing not only improves scalability, cost-effectiveness, and data security but also facilitates the integration of emerging technologies like the Internet of Things (IoT). IoT devices—such as remote sensors and GPS trackers—continuously collect real-time data on land conditions, infrastructure health, and environmental factors, which is transmitted to the cloud for immediate analysis. This integration ensures that land managers and other stakeholders have access to the most current information, enabling timely, informed decision-making and effective responses to emerging challenges and opportunities. Overall, the work underscores the transformative potential of combining cloud-based LIS with IoT to create a dynamic, collaborative, and data-driven land management ecosystem that supports sustainable planning, infrastructure monitoring, and environmental management.

The aim will be achieved by conducting a comprehensive assessment of existing Land Information System infrastructure and stakeholder needs to guide the migration process. The LIS will be migrated to a secure, scalable cloud platform that supports real-time data access and collaboration. Appropriate IoT devices, such as soil sensors and structural monitors, will be deployed to continuously collect land and infrastructure data. Reliable connectivity solutions will be established to ensure uninterrupted data transmission from IoT devices to the cloud. Automated data ingestion pipelines and advanced analytics tools will be developed within the cloud environment to process and visualize real-time information. Alert and decision support systems will be implemented to enable timely responses to emerging issues. Pilot projects will be conducted to validate system functionality, followed by stakeholder training to maximize effective use. Continuous feedback will be gathered to refine and optimize the system, with plans for scaling, integration of emerging technologies, and sustainable maintenance established to ensure long-term success.

CHAPTER THREE

3.0 METHODOLOGY

The following are the methodology adopted in carrying out land information system analysis of *part of Asa-Dam community area*, Ilorin, Asa local government area,Nigeria.

3.1 RECONNAISSANCE

This is the preliminary field inspection of the project site to be surveyed. It involves the overall view of the entire land in question or the project site in order to plan on how to go about the surveying operation to achieve the aim of the work in accordance with the survey rules and regulation pertaining to the order of job required (i.e. first. Second or third order), the reconnaissance was done by considering the purpose of the survey operation and method of observation. There are the two types of reconnaissance that are carried out are:-

- Office Reconnaissance
- Field Reconnaissance

3.2.1OFFICE RECONNAISSANCE

Information about the study area like existing map/plan of the project site and preferably historical data of the site in question, letter of notification, necessary information equipment needed to carry out the survey and coordinates of control point was carried out under this section.

3.2.2FIELD RECONNAISSANCE

At this stage, we visited the project area and take note of the crucial points, locating of existing control points, drawing of the reconnaissance diagram and also the determination of the best method for the Survey.

3.3.1EQUIPMENT USED

Total Station and its accessories.

3.3.2 HARDWARE

1. Laptop Computer

2. Mouse

3, Printer etc.

3.3.3SOFTWARE

The following Software was used:

1. Microsoft word
2. Microsoft Excel
3. Note Pad
4. Google Earth
5. ArcGis 10.0

3.4 CONTROL CHECK/ CONTROL COMPARISON METHOD

It is not enough to work from whole to part but it is equally expected that the set of controls to be used are properly checked to ascertain their suitability for the job.

3.5 CONTROL CHECK PROCEDURE (Control Comparison Method)

In order to ensure the reliability and accuracy of the existing control network, a control comparison was conducted as part of the pre-observation checks. This procedure involved reoccupying selected known control points within the project area and measuring their spatial relationships (coordinates, bearings, and distances) to other established points. The results were then compared with the original coordinate records to determine any positional shifts or inconsistencies.

Procedure:

1. The total station was set up over a known control point, leveled, and oriented.

2. Observations (angles and distances) were taken to adjacent known control points.

3. Coordinates of the observed points were computed based on the measurements.

4. The computed coordinates were compared against the recorded coordinates.

5. Differences (ΔEasting, ΔNorthing, ΔElevation) were calculated for each control point.

Table 3.4.1: Coordinate of the observed and the original values of PT 31

PILLAR	**NORTHING**	**EASTING**	**STATUS**	**REMARKS**
PT 31 (KW/AW/ 1206)	934630.687	668601.336		ORIGINAL
PT 31 (KW/AW/1206)	934630.677	668601.356	FIXED	OBSERVED
DISCREPANCY	0.010	0.020		

Table 3.4.2: Coordinate of the observed and the original values of PT 32

PILLAR	NORTHING(m)	EASTING(m)	STATUS	REMARKS
PT32 (KW/RB/37)	934634.584	668590.327		ORIGINAL
PT32 (KW/RB/37)	934634.563	668590.349	FIXED	OBSERVED
DISCREPANCY	0.021	0.022		

Table 3.4.3: Coordinate of the observed and the original values of PT 33

PILLAR	NORTHING(m)	EASTING(m)	STATUS	REMARKS
PT33 KW/RS/12210)	934663.590	668506.841		ORIGINAL
PT33 KW/RS/12210)	934663.579	668506.861,	FIXED	OBSERVED
DISCREPANCY	0.011	0.020		

3.5.1 DATA SOURCE

Control coordinate were given from existing map, which is considered as secondary data. This was plotted using AutoCAD. There are two main source of data used primary and secondary source.

3.5.2PRIMARY SOURCE

This involve the collection of the X,Y and Z coordinate (Spatial data) using land surveying Technique with Total Stationand its a/ccessories.

3.5.3 SECONDARY SOURCE

This type of source that was gotten from the google earth application for land information system of part of Asa DamAgaka S area. Ilorin, Kwara State.

3.6.1GEOMETRIC DATA ACQUISITION

This involve the acquisition of both northing, easting and height value of features that are present on the project site. The instrument was set on one of the control points and backsight and foresight to the other controls respectively. After which the traversing was carried out and recorded such as (angles & distances). In the aspect of this project , digital land survey method was adopted.

1. Composite on Autocad.
2. Shewing co.mposite
3. Vacant area.
4. Only built-up area.
5. Label the building.

3.6.2 PERIMETER

This coordinate of the boundary pillar of the project site were obtained through perimeter traversing of the area

3.6.3DETAILING

Detailing refer to fixing of features that are found in an area where survey operation had been carried out. Building, Roads, Electricity pole and other facilities located within the project area were detailed using land survey method.

3.6.4ATTRIBUTE/ SOCIAL SURVEY

This aspect of data acquisition entails the collection of other data which geometric in nature. Such data were directly related to the features to which geometric data was acquired. They included building names, the purpose of which the building is used for etc.

To collect attribute data, survey was employed. This involve oral interviews, reading information from sign posts, wall signs, virtual observation, etc.

3.7.1DATABASE CREATION/IMPLEMENT

For efficient and effective management of data in the computer environment, data item are usually arranged and stored in a database or databank. The content of this database could be in form of a text, number, polygon or graphics. The creation of this database involved the combination and storage of the acquired graphical and attributes data obtained in former designed GIS database of a generic structure for the purpose in spatial analysis and queries on project site

In the creation of a land information system data mode, a widely used technique called layering was employed. The features that are present within the project site have been classified into different layers in the AutoCAD software independently. The polyline entities were joined using the polyline tool while appropriate symbols were used for the point entities. These layers were then exported to ArcGIS environment where shape files was created using attributes fields as conceptualized in the schema. These attribute table were then populated accordingly with attributes values for each particular entity as observed in the field and from the social survey template (attached as appendix)

The personal Geo database was then created finally in Arc Catalog environment. Where other tables that are non-geometric where created while the already created shape files where imported. Relationship between these tables were also established and the tables were later populated in the Arc Map environment. The following are some of the table created

3.7.2DATABASE MANAGEMENT SYSTEM (DBMS)

According to Dale and McLaughlin (1998), database management system was defined as a computer program to control the storage, retrieval and modification of data in the database. DBMS comprises of set of programmers which are used to maintain and manipulate the data orderly and acts as the central control over all the interactions. It is manages that data using alphanumeric data with limited capabilities of performing spatial queries

A DBMS must allow the definition of data and their attributes and relationships as well as providing security and on interface between the end users and their application and the data themselves it reduces redundancy. Therefore, Arc GIS 10.0version was used to create, manipulate, maintain and access the database easily.

3.7.3DATA QUALITY

Some forms of quality control and quality assurance were incorporated in the project at every phase. These include conformity with data templates, data competences and data accuracy. Conformity with data templates in this premises refers to the degree to which the captured data conformed with the designed templates, while data competence was understood as the degree to which the available data in the report and for which there are specific templates have been extracted.

3.7.4 DATA INTEGRITY

The data captured as exactly downloaded into the system then exported to AutoCAD via notepad and eventually into Arc GIS. The process involves ensuring that the data in the database were accurate and setting of certain constraint to prevent inconsistency in the database.

3.7.5DATA SECURITY

Security is of great concern to land administration because of the legal implication of cadastral records. Security of the records is of almost importance to all concerned. This includes:

- Physical and system security
- Physical security: The use of burgling proof, firefighting equipment controlled access, proper records of the moment of personal and our of the office circuit break
- System Security: Uninterrupted power supply (UPS) will be used to control voltage, use of passwords and backups

In view of the foregoing, locking mechanism was adopted to protect the data in the database from unconscious deletion. Password was used to prevent unauthorized user from breaking into the database and a back up was created for the whole project on the rentable DVD.

Having succeeded in analysis the methodology employed in the execution of this project to arrive at the successful completion. It is equally necessary to examine the processes undertaken to ascertain the reliability and effectiveness of the created land information system

3.8.1DATA PROCESSING

CivilCAD, AutoCAD and ArcGIS were used for plotting and database creation.

3.8.2DRAFTING AND PLOTTING

During plotting of the data, Civil CAD was firstly used to plot out all the points that are picked on the field. The downloaded data of those points were well arranged in the Microsoft excel. The following steps were carried out:

1. The data was save on the desktop for easy location
2. AutoCAD 2007 was open the CivilCAD2012 was launched on it,

3. All the necessary parameters were set ranging from the drawing units, text, point style and others
4. The data was then located on the desktop through the Civil CAD and opened,
5. The refresh button was clicked and the data was refresh with a successful message displayed
6. Then the zoom extend was used to bring all the plotted point into view.

The Civil CAD plotted the coordinate along with their point ID and this make the detailing of the features (such as Roads, electric poles and other) quite easier when transfer into AutoCAD environment.

3.8.3DATABASE CREATION PROCEDURES

The plan in the AutoCAD format was added as data on ArchMap10.0. on Arc Catalog, a file Geo-database was created and subsequently a feature classes such as the line feature for the roads and others and polygon feature for the buildings.

Below are the procedures:

1. A folder was created for the project on the desktop and the plan with Dwgextension was saved in it,

2. ArcMap in ArcGIS10.0 software was launched

3. Then an empty new map which was displayed after loading was clicked on the minimize catalog on the right side was then maximize to view the ready created folder which contain the drawing in the AutoCAD format. The drawing was dragged from the folder and placed on the empty map and then the coordinate system was set.

CHAPTER FOUR

4.0SPATIAL ANAYSIS, DATA PROCESSING AND PRESENTATION

4.1 SPATIAL ANALYSIS

Spatial analysis is a specialized function that distinguish GIS from other information systems. It entails the examination of spatial and attributes characteristics of geographic features that are within the database to establish relationships from which spatial problems can be tackled. In this project work, spatial analyses were performed to select, combine and intersect existing geospatial data-sets in order to generate new information suitable for answering specific spatially-related questions.

The results from these analyses can be shown in a number of ways depending on the required output format. Where attribute information about map features are required, they can be presented as tables containing such valves as are needed from the query analysis. They can also be presented as maps with legend information showing the queried features and their topological relationships with other features shown on the map.

4.2. TESTING OF DATABASE

This is carried out to ascertain the quality of the database created, it was necessary to tryout the database so as to determine if information could be readily retrieved from it as required. Testing the database was important to determine whether the established relationships between features and their characteristics attributes are so represented on the database.

4.3.1 QUERIES

Queries are specific questions in the form of "what is where", "where is what", "when" or how long has it been there.This provides answer to the needed information through processing or manipulating spatial data.

4.3.2SPATIAL QUERY

Queries were designed for the purpose of retrieving information from the database. The queries performed in this project gave answers to certain generic questions asked from the database. This was made possible as a result of the implicit link of both the spatial and attributes data. The queries were based on the products from the analysis carried out on the database.

4.4 SINGLE CRITERION QUERY

A single criterion is carried out where one condition is used to design query. This condition is used to retrieve the information from the database. An example of a single criteria query is shown below

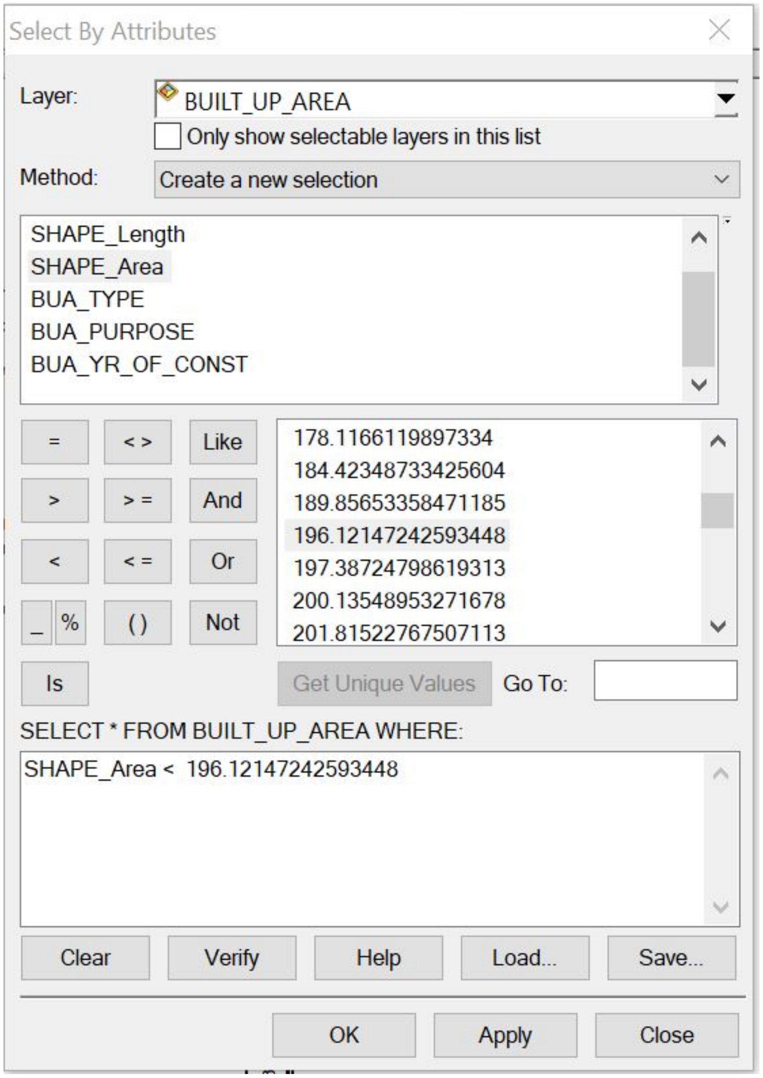


Figure: 4.4.1 Shows a single query made on the database of the project

Query 1: The query one is in interested in selecting or showing the built up area that have an area less than 196.12msq/m^2

Syntax:built _up _area <196.12msq/m^2

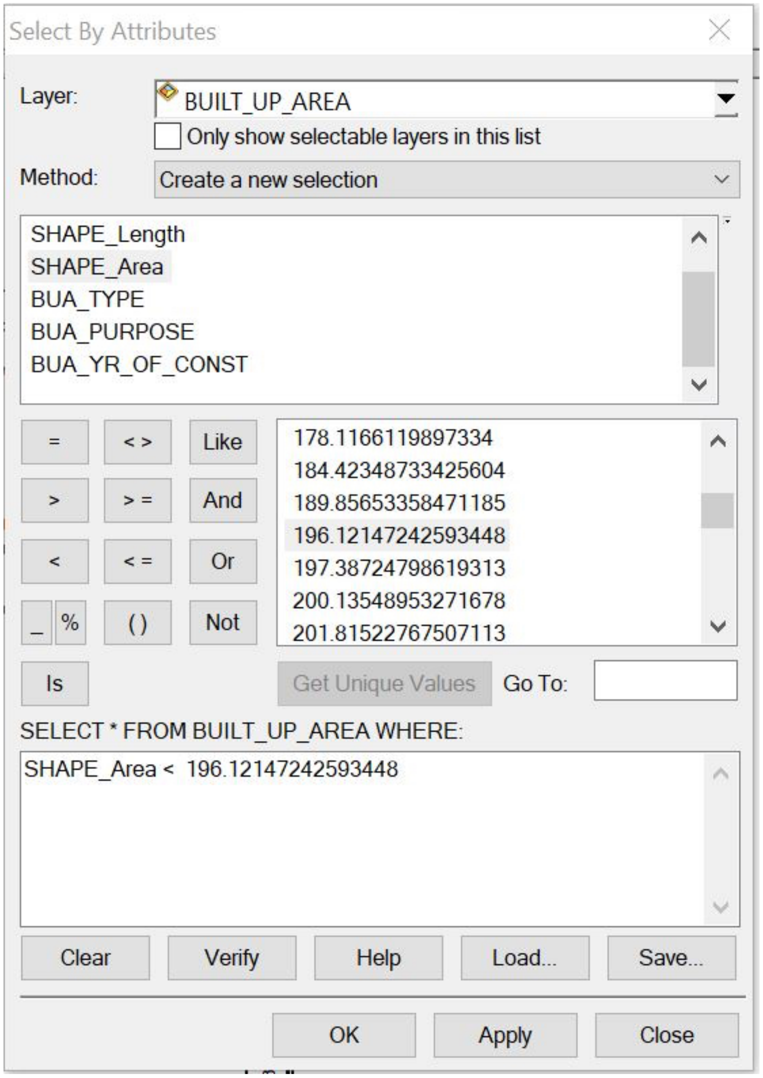


Figure: 4.4.2 showing the question made on the database for built _up _area <196.12msq/m2

Table

BUILT_UP_AREA

OBJE	SHAPE *	SHAPE_Le	SHAPE_Area	BUA_TYPE	BUA_PURPOSE	BUA_YR_OF_CONST
1	Polygon	58.79	197.39	BUNGALOW	COMMERCIAL	1984
2	Polygon	59.29	200.14	BUNGALOW	PRIVATE	2000
3	Polygon	60.05	201.82	BUNGALOW	PRIVATE	1984
4	Polygon	58.87	189.86	BUNGALOW	RESISDENTIAL	2000
5	Polygon	63.09	232.88	BUNGALOW	PRIVATE	1984
6	Polygon	63.43	248.62	BUNGALOW	PRIVATE	1997
7	Polygon	58.19	184.42	BUNGALOW	RESISDENTIAL	1984
8	Polygon	40.32	74.74	BUNGALOW	PRIVATE	2000
9	Polygon	44.78	108.13	BUNGALOW	RESISDENTIAL	1984
10	Polygon	72.14	266.35	BUNGALOW	PRIVATE	1984
11	Polygon	76.97	332.38	A_STORY	COMMERCIAL	1998
12	Polygon	98.16	493.55	A_STORY	RESISDENTIAL	1984
13	Polygon	167.39	1087.66	BUNGALOW	COMMERCIAL	2024
14	Polygon	86.23	414.74	THREE_STORY	RESISDENTIAL	2024
15	Polygon	87.24	424.53	A_STORY	PRIVATE	2000
16	Polygon	76.59	337.83	BUNGALOW	COMMERCIAL	1984
17	Polygon	88.15	353.02	BUNGALOW	RESISDENTIAL	2024
18	Polygon	75.56	284.91	THREE_STORY	COMMERCIAL	2016
19	Polygon	74.48	294.31	TWO_STORY	PRIVATE	2020
20	Polygon	89.3	393.22	BUNGALOW	RESISDENTIAL	2016
21	Polygon	56.43	196.12	TWO_STORY	PRIVATE	2014
22	Polygon	32.61	66.28	BUNGALOW	RESISDENTIAL	2023
23	Polygon	35.76	78.9	A_STORY	COMMERCIAL	2016
24	Polygon	31.13	57.27	BUNGALOW	RESISDENTIAL	2023
25	Polygon	29.55	52.69	TWO_STORY	RESISDENTIAL	2016

1 (15 out of 44 Selected)

BUILT_UP_AREA

Figure: 4.4.3 showing the result of the query made on the database for built _up _area <196.12msq/m2 in form of a table

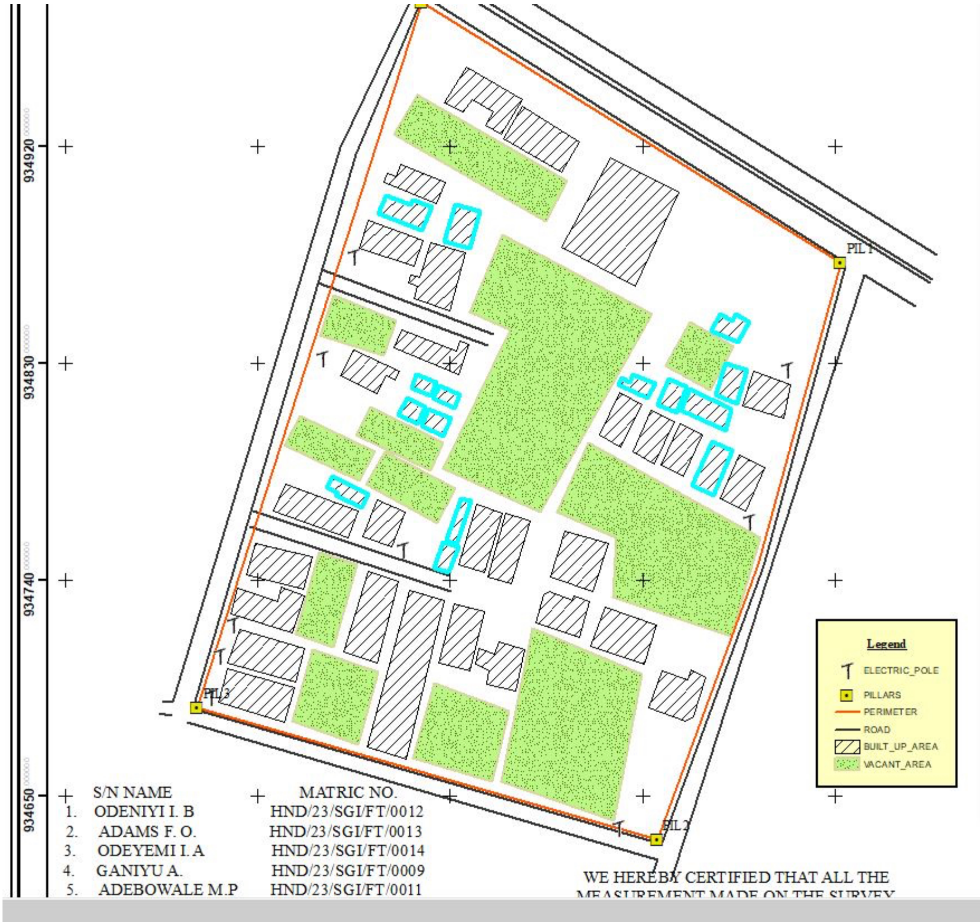


Figure: 4.4.4showing the result of the query made on the database for built _up _area <196.12msq/m^{2}on the plan

Discussion of Result

Figure 4.4.3 and 4.4.4 Shows the built up area that have an area less than 196.12msq/m It consists of the syntax model or the query builder box, attribute table as well as the map of the selected plot in mint blue color. The result shows that 15 built_up_areaout of the 44built _up _area have an area less than 196.12msq/m^2

4.5 MULTIPLE CRITERIA QUERY

The database created is then used for implementing several selection queries in determination of user-defined requirements such as built up area whose purpose are for commercial or private use, year of construction, type of building (bungalow,2 story, duplex etc.) and other security which will be effective in planning in such environment.

Query2: The query 2 is interested in showing the building area that are greater than 403.99$m^2$and their purpose that are used for commercial

Syntax:built_up_ area > 403.99 m^2ANDtheir purpose are for commercial use.

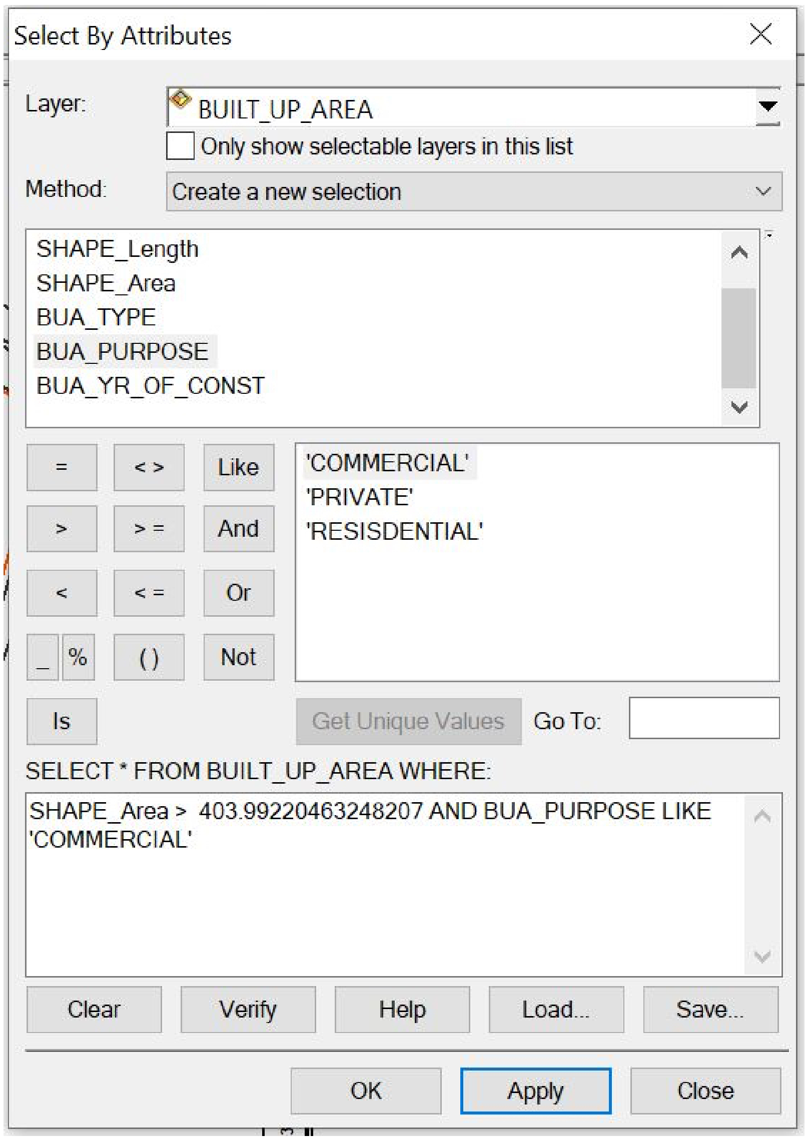


Figure:4.5.1 showing the question made on the databasefor built _up_ area > 403.99m^2 and their purpose are for commercial use.

Table

BUILT_UP_AREA

OBJE	SHAPE *	SHAPE_Le	SHAPE_Area	BUA_TYPE	BUA_PURPOSE	BUA_YR_OF_CONST
11	Polygon	76.97	332.38	A_STORY	COMMERCIAL	1998
12	Polygon	98.16	493.55	A_STORY	RESISDENTIAL	1984
13	Polygon	167.39	1087.66	BUNGALOW	COMMERCIAL	2024
14	Polygon	86.23	414.74	THREE_STORY	RESISDENTIAL	2024
15	Polygon	87.24	424.53	A_STORY	PRIVATE	2000
16	Polygon	76.59	337.83	BUNGALOW	COMMERCIAL	1984
17	Polygon	88.15	353.02	BUNGALOW	RESISDENTIAL	2024
18	Polygon	75.56	284.91	THREE_STORY	COMMERCIAL	2016
19	Polygon	74.48	294.31	TWO_STORY	PRIVATE	2020
20	Polygon	89.3	393.22	BUNGALOW	RESISDENTIAL	2016
21	Polygon	56.43	196.12	TWO_STORY	PRIVATE	2014
22	Polygon	32.61	66.28	BUNGALOW	RESISDENTIAL	2023
23	Polygon	35.76	78.9	A_STORY	COMMERCIAL	2016
24	Polygon	31.13	57.27	BUNGALOW	RESISDENTIAL	2023
25	Polygon	29.55	52.69	TWO_STORY	RESISDENTIAL	2016
26	Polygon	66.95	228.3	BUNGALOW	PRIVATE	2023
27	Polygon	83.45	259.71	A_STORY	RESISDENTIAL	2016
28	Polygon	87.9	403.99	TWO_STORY	PRIVATE	2014
29	Polygon	72.3	288.19	BUNGALOW	RESISDENTIAL	2021
30	Polygon	59.85	178.12	THREE_STORY	PRIVATE	2014
31	Polygon	53.56	171.57	A_STORY	RESISDENTIAL	2016
32	Polygon	151.62	1414.53	TWO_STORY	RESISDENTIAL	2024
33	Polygon	86.23	425.98	THREE_STORY	COMMERCIAL	2022
34	Polygon	78.75	386.46	BUNGALOW	RESISDENTIAL	2014
35	Polygon	80.36	394.73	TWO_STORY	RESISDENTIAL	2024

1 (2 out of 44 Selected)

BUILT_UP_AREA

Figure: 4.5.2 showing the result of the query made on the databasefor built _up_ area > 403.99 m2 and their purpose are for commercial usein form of a table.

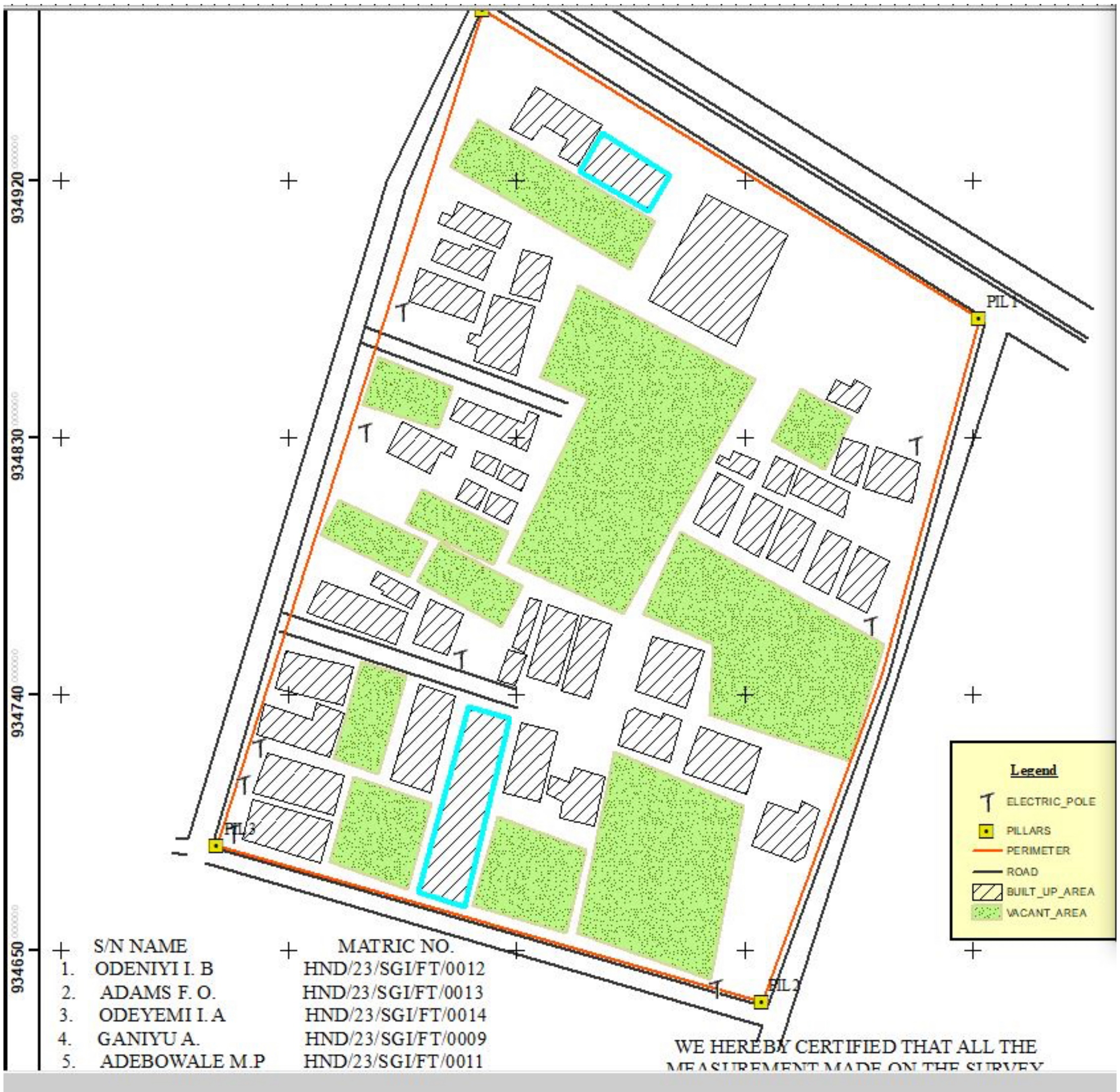


Fig: 4.5.3 showing the result of the query made on the database for built _up_ area > 403.99 m^2 and their purpose are for commercial use on the plan

Discussion of Result

Figure 4.5.2 and 4.5.3 Shows the built _ up _ area > 403.99$m^2$and purpose are commercial on the planIt consists of the syntax model or the query builder box, attribute table as well as the map of the selected plot in mint blue color. The result shows that 2 built _up _area out of the 44 built _up _area have an area greater than 403.99 m^2 and their purpose are for commercial use.

Query3: The query 3 is interested in showing the vacant area less than or equal to 901.99m and are not fenced to query about the vacant area of land less than or equal to 901.13$m^2$and are not fenced

Syntax: vacant_ area <= to 901.13m^2AND are not fenced

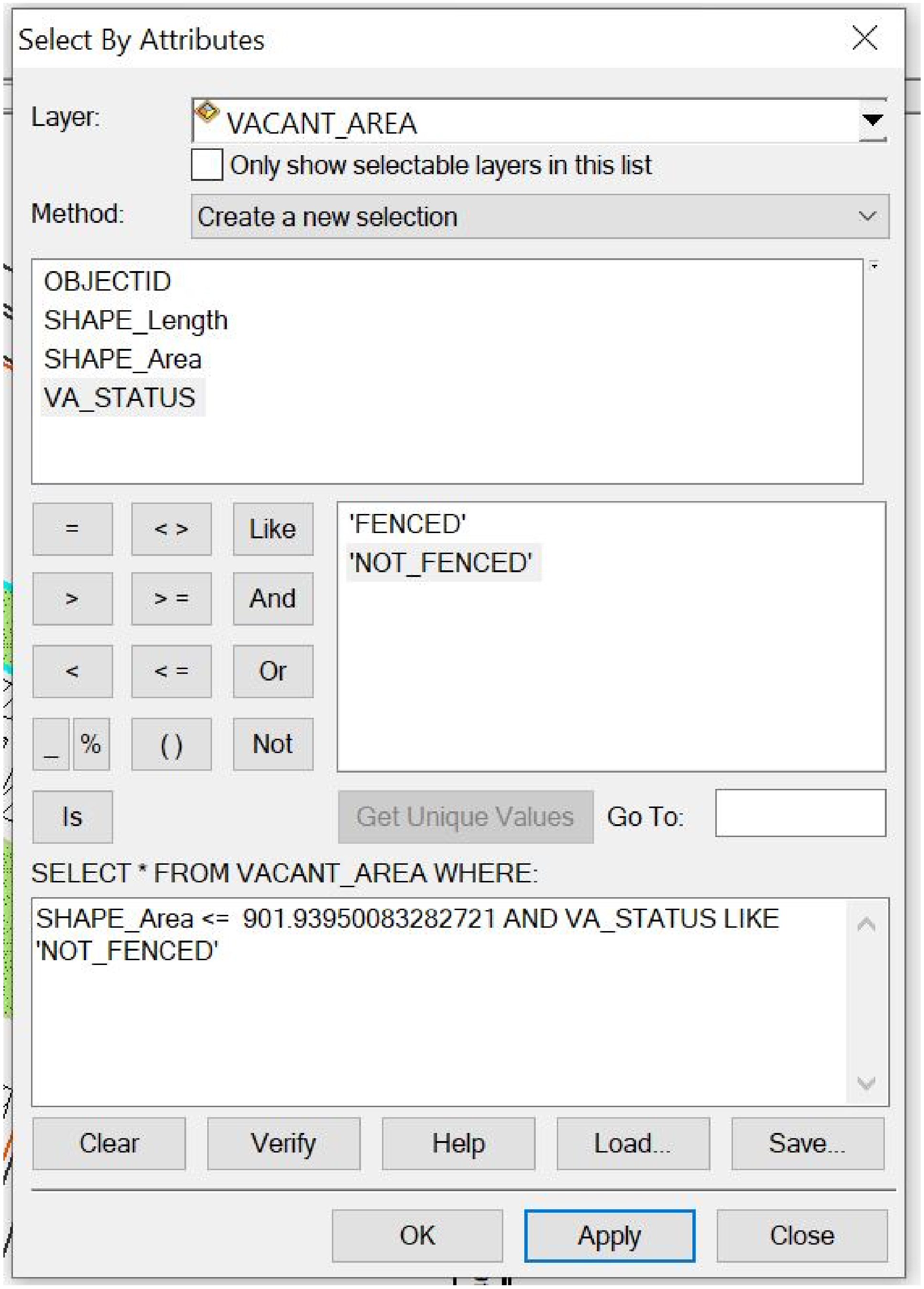


Figure: 4.5.6showing the question made on the database for vacant_ area less than or equal to 901.93$m^2$and are not fenced.

Table

VACANT_AREA

OBJECTID *	SHAPE *	SHAPE_Length	SHAPE_Area	VA_STATUS
1	Polygon	326.795276	5184.980124	FENCED
3	Polygon	260.160996	3468.70836	NOT_FENCE
4	Polygon	225.41265	3077.945598	NOT_FENCE
7	Polygon	130.153174	1054.036574	NOT_FENCE
8	Polygon	120.355738	901.939501	NOT_FENCE
9	Polygon	104.213638	590.20018	FENCED
10	Polygon	99.075483	538.454581	NOT_FENCE
11	Polygon	96.451476	473.272325	FENCED
12	Polygon	93.354325	432.107734	NOT_FENCE
13	Polygon	88.695678	459.875527	NOT_FENCE
14	Polygon	182.724732	1368.627373	FENCED
15	Polygon	82.846905	428.80538	NOT_FENCE

(5 out of 12 Selected)

VACANT_AREA

Figure: 4.5.7showing the result of the query made on the database for vacant_ area <= 901.13m2and are not fenced in form of a table.

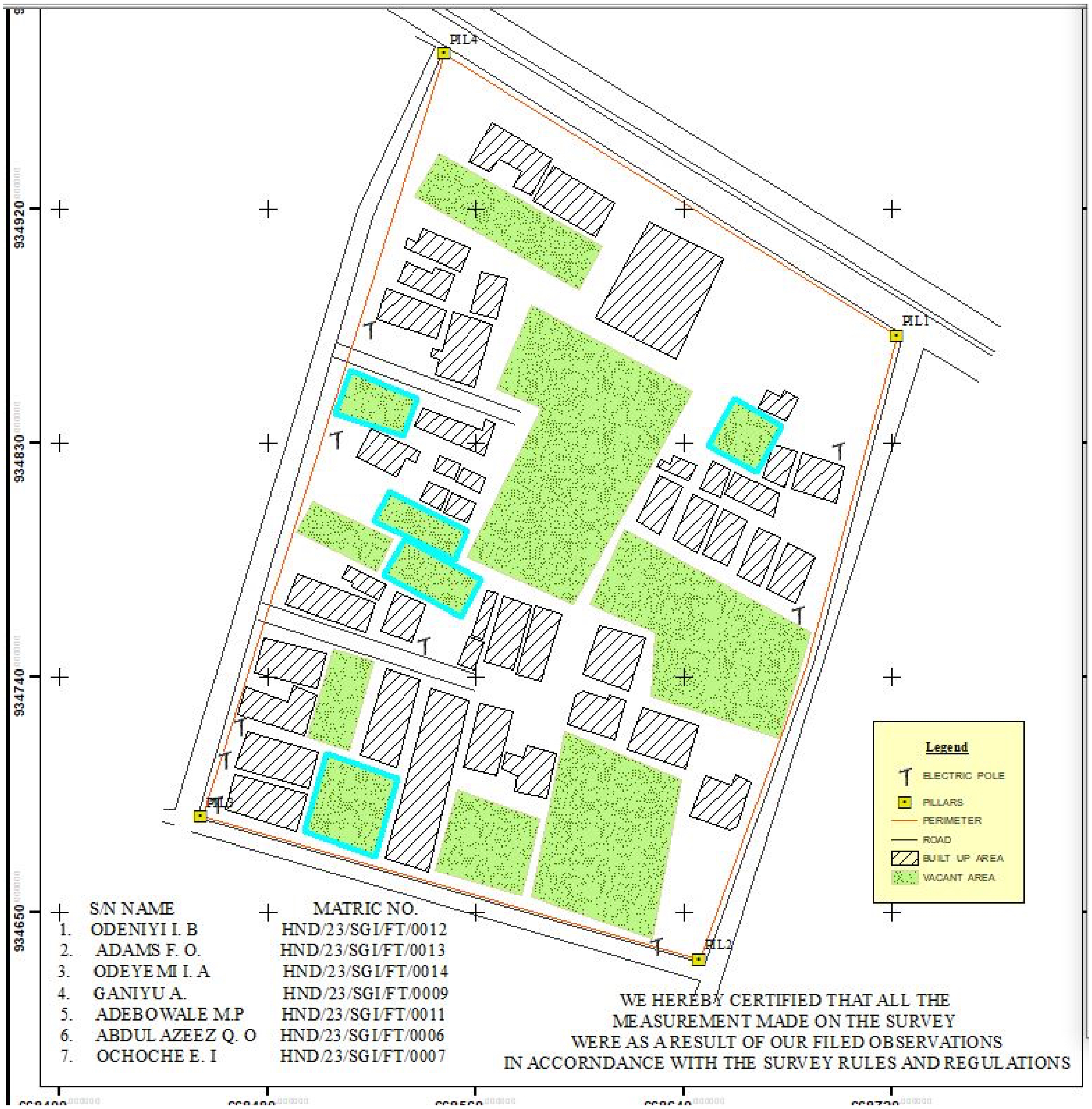


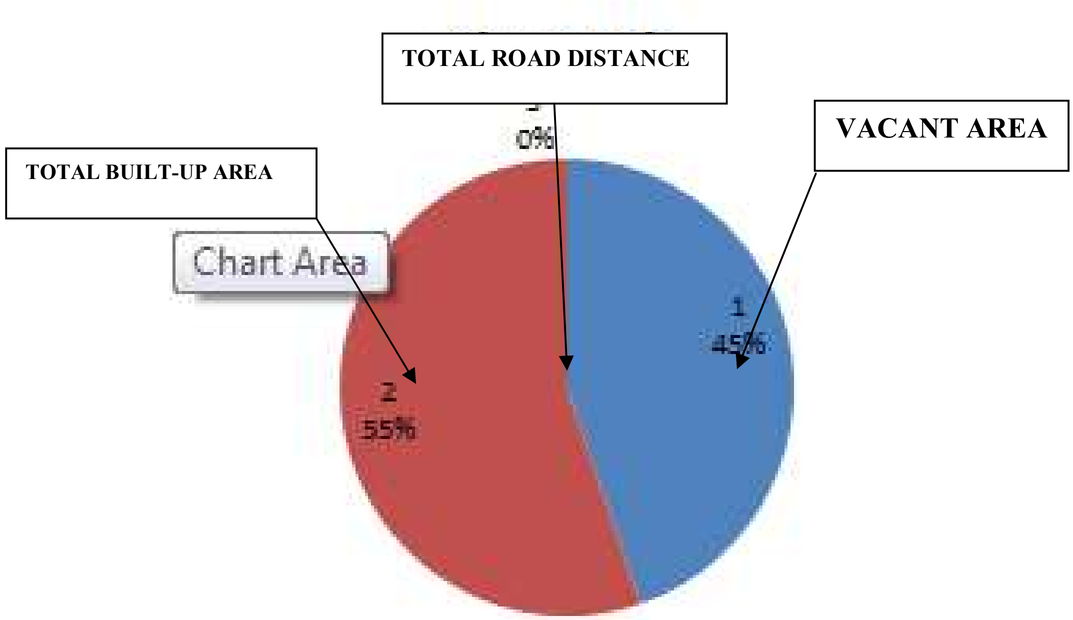
Figure: 4.5.8 showing the result of the query made on the database for vacant_ area <= 901.93m2and are not fenced on the plan.

Discussion of Result

Figure 4.5.7 and 4.5.8 Shows the vacant area less than or equal to 901.93m^{2}and are not fenced on the plan It consists of the syntax model or the query builder box, attribute table as well as the map of the selected plot in mint blue color. The result shows that 5 vacant_area out of the 12vacant _area have an area less than 901.93m^2 and are not fenced.

4.6 RESULTS ANALYSIS

LOCATION	SIZE	PERCETAGE
Total built Up Area	**1285.2724**	**42.3%**
Vacant area	**48165.342**	**52.2%**
Total Road Distance (meters)	**1685.195**	5.5%



4.7APPLICATION OF PRODUCT

1. It facilitates the use of GIS for effective land management and physical planning.
2. It can be used for distribution of infrastructural facility in the study area.
3. It can be used for decision making in various school management processes.
4. It can be used for utility distribution, planning and operation.
5. The product will provide an integrated approach to analysis of land information.
6. It can be used for sustainable land development project in the study area

4.8 SPATIAL SEARCH

The database developed/created was queried in order to reduce the spatial variation in the various information categories ranging from built up area, vacant area, electric poles, and roads (as revealed by the database created) were used for the information system.

4.9 SPATIAL DEPENDENCE

Information system is not the same in every place, even within the project area, to talk of the whole institution neither the whole state, therefore, to detect the information increment/decrement within Part of Asa Dam area,Agaka (which is the study area) the strength of spatial relationships between the attributes must be established, the strength is known as "Spatial Dependence" and is based on Waldo Tabler's "First Law of Geography" whereby everything is related to everything else, but closer things are more related. Spatial dependence must be measured to establish a relationship limit between the environment and how the facilities is used by the people. This dependence will likely changes over the study area as the environmental factors change (Haining, 2003). This is known as a spatial process, and when it changes across space it will non-stationery. This cannot be measured just by visually determining what is on ground because it is subjective and this must be done with a scientific approach to achieve a more concrete and precise information.

Screen-shot showing the database created for the study area

Table

BUILT_UP_AREA

OBJE	SHAPE *	SHAPE_Le	SHAPE_Area	BUA_TYPE	BUA_PURPOSE	BUA_YR_OF_CONST
1	Polygon	58.79	197.39	BUNGALOW	COMMERCIAL	1984
2	Polygon	59.29	200.14	BUNGALOW	PRIVATE	2000
3	Polygon	60.05	201.82	BUNGALOW	PRIVATE	1984
4	Polygon	58.87	189.86	BUNGALOW	RESISDENTIAL	2000
5	Polygon	63.09	232.88	BUNGALOW	PRIVATE	1984
6	Polygon	63.43	248.62	BUNGALOW	PRIVATE	1997
7	Polygon	58.19	184.42	BUNGALOW	RESISDENTIAL	1984
8	Polygon	40.32	74.74	BUNGALOW	PRIVATE	2000
9	Polygon	44.78	108.13	BUNGALOW	RESISDENTIAL	1984
10	Polygon	72.14	266.35	BUNGALOW	PRIVATE	1984
11	Polygon	76.97	332.38	A_STORY	COMMERCIAL	1998
12	Polygon	98.16	493.55	A_STORY	RESISDENTIAL	1984
13	Polygon	167.39	1087.66	BUNGALOW	COMMERCIAL	2024
14	Polygon	86.23	414.74	THREE_STORY	RESISDENTIAL	2024
15	Polygon	87.24	424.53	A_STORY	PRIVATE	2000
16	Polygon	76.59	337.83	BUNGALOW	COMMERCIAL	1984
17	Polygon	88.15	353.02	BUNGALOW	RESISDENTIAL	2024
18	Polygon	75.56	284.91	THREE_STORY	COMMERCIAL	2016
19	Polygon	74.48	294.31	TWO_STORY	PRIVATE	2020
20	Polygon	89.3	393.22	BUNGALOW	RESISDENTIAL	2016
21	Polygon	56.43	196.12	TWO_STORY	PRIVATE	2014
22	Polygon	32.61	66.28	BUNGALOW	RESISDENTIAL	2023
23	Polygon	35.76	78.9	A_STORY	COMMERCIAL	2016
24	Polygon	31.13	57.27	BUNGALOW	RESISDENTIAL	2023

(0 out of 44 Selected)

BUILT_UP_AREA

Table

VACANT_AREA

OBJECTID *	SHAPE *	SHAPE_Length	SHAPE_Area	VA_STATUS
1	Polygon	326.795276	5184.980124	FENCED
3	Polygon	260.160996	3468.70836	NOT_FENCE
4	Polygon	225.41265	3077.945598	IOT_FENCED
7	Polygon	130.153174	1054.036574	NOT_FENCE
8	Polygon	120.355738	901.939501	NOT_FENCE
9	Polygon	104.213638	590.20018	FENCED
10	Polygon	99.075483	538.454581	NOT_FENCE
11	Polygon	96.451476	473.272325	FENCED
12	Polygon	93.354325	432.107734	NOT_FENCE
13	Polygon	88.695678	459.875527	NOT_FENCE
14	Polygon	182.724732	1368.627373	FENCED
15	Polygon	82.846905	428.80538	NOT_FENCE

3 (0 out of 12 Selected)

VACANT_AREA

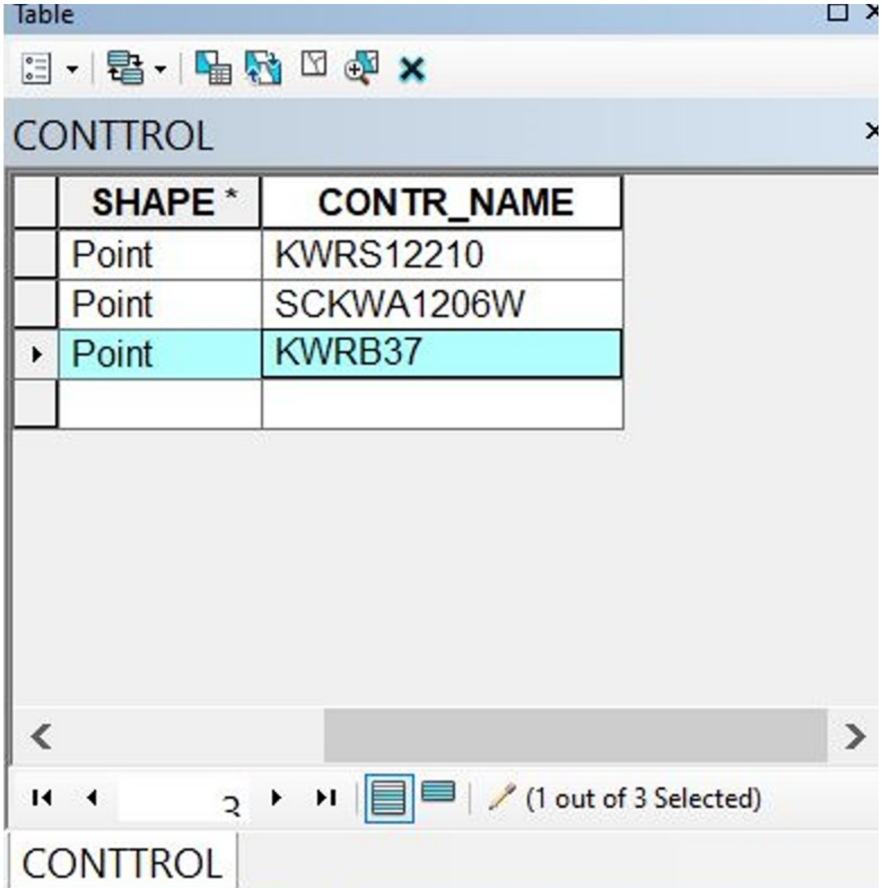
Table

ROAD

OBJECTID *	SHAPE *	SHAPE_Length	RD_NAME	RD_WIDTH	RD_TYPE	RD_COND
1	Polyline	263.742299	ASADAM_ROAD	10.00	DUAL_RD	GOOD
2	Polyline	299.615887	ASADAM_ROAD	10.00	DUAL_RD	GOOD
3	Polyline	295.907494	ASADAM_ROAD	10.00	DUAL_RD	GOOD
4	Polyline	289.89555	AJEGUNLE_ROAD	<Null>	SINGLE_RD	FAIR
5	Polyline	210.104546	ACCESS_ROAD	6.50	SINGLE_RD	FAIR
6	Polyline	4.930797	ACCESS_ROAD	5.30	SINGLE_RD	FAIR
7	Polyline	323.289022	ACCESS_ROAD	6.10	SINGLE_RD	BAD
8	Polyline	311.861776	ACCESS_ROAD	6.10	SINGLE_RD	BAD
9	Polyline	203.363632	ACCESS_ROAD	6.00	SINGLE_RD	FAIR
11	Polyline	299.630492	ASADAM_ROAD	10.00	DUAL_RD	GOOD
12	Polyline	254.565297	AJEGUNLE_ROAD	9.00	SINGLE_RD	FAIR
13	Polyline	75.555387	CLOSE_ROAD	5.60	SINGLE_RD	FAIR
14	Polyline	76.194179	CLOSE_ROAD	5.60	SINGLE_RD	FAIR
15	Polyline	87.627684	CLOSE_ROAD	5.60	SINGLE_RD	FAIR
16	Polyline	86.193792	CLOSE_ROAD	5.60	SINGLE_RD	FAIR

15 (0 out of 15 Selected)

ROAD



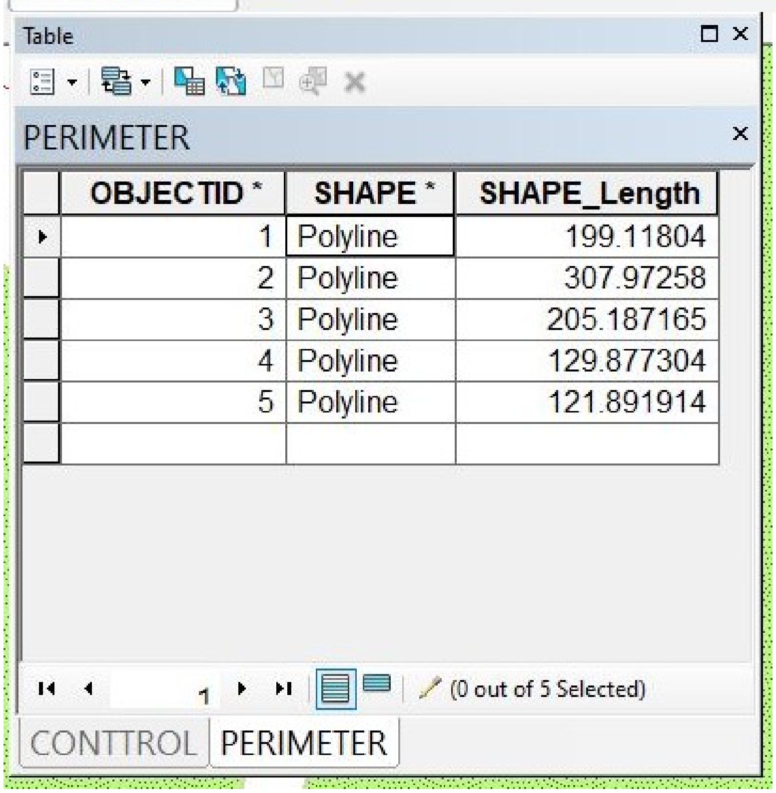
Table

CONTTROL

SHAPE *	CONTR_NAME
Point	KWRS12210
Point	SCKWA1206W
Point	KWRB37

3 (1 out of 3 Selected)

CONTTROL



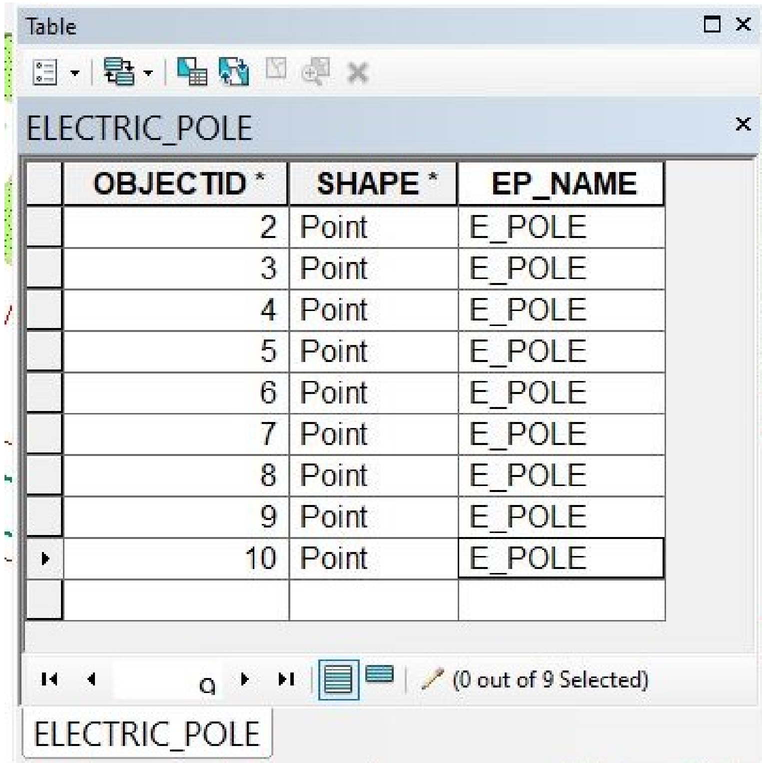
Table

PERIMETER

OBJECTID *	SHAPE *	SHAPE_Length
1	Polyline	199.11804
2	Polyline	307.97258
3	Polyline	205.187165
4	Polyline	129.877304
5	Polyline	121.891914

1 (0 out of 5 Selected)

CONTTROL PERIMETER



OBJECTID *	SHAPE *	EP_NAME
2	Point	E_POLE
3	Point	E_POLE
4	Point	E_POLE
5	Point	E_POLE
6	Point	E_POLE
7	Point	E_POLE
8	Point	E_POLE
9	Point	E_POLE
10	Point	E_POLE

CHAPTER FIVE

5.0 COSTING. SUMMARY, CONCLUSION, AND RECOMMENDATION.

5.1 COSTING

The costing of this project was done using the Nigeria Institution of Surveyor's (NIS) professional scale of fees for consultant in the construction industry. This stage shows the total cost that was spent on the project from day one to the final stage.

RECCI

PERSONAL/QUALITY	DAY(S)	UNITRATE(N)	TOTAL AMOUNT(₦)
1 Senior Surveyor	1	15,000.00	15,000.00
Assistant Surveyor	1	8,000.00	8,000.00
Transportation	1	7,000.00	7,000.00
Basic Equipment	1	8,000.00	7,000.00
TOTAL			#38,000.00

BEACON= 2,100 × 5

= #10,500

\

BEACONING

PERSONAL/QUALITY	DAY(S)	UNITRATE(N)	TOTALAMOUNT(₦)
1Assistant Surveyor	1	8,000.00	8,000.00
Basic Equipment(6)	1	8,000.00	8,000.00
Transportation	1	7,000.00	7,000.00
TOTAL			#23,000.00

TRAVERSING

PERSONAL/QUALITY	DAY(S)	UNITRATE(N)	TOTALAMOUNT(₦)
1 Assistant Surveyor	2	8,000.00	16,000.00
BasicEquipment	2	8,000.00	16,000.00
Transportation	2	7,000.00	14,000.00
TOTAL			#46,000.00

DOWNLOADING DATA AND PLOTTING

PERSONAL/QUALITY	DAY(S)	UNITRATE(N)	TOTALAMOUNT(₦)
1Senior Surveyor	2	15,000.00	30,000.00
1AssistantSurveyor	2	8,000.00	16,000.00
Transportation	2	7,000.00	14,000.00
Consumables	2	7,000.00	14,000.00
TOTAL			#74,000.00

INFORMATION PRESENTATION

PERSONAL/QUALITY	DAY(S)	UNITRATE(N)	TOTALAMOUNT(₦)
1Assistant Surveyor	1	8,000.00	8,000.00
Transportation	1	7,000.00	7,000.00
TOTAL			#15,000.00

(1) # 38,000.00

(2) # 10,500.00

(3) # 23,000.00

(4) # 46,000.00

(5)#74,000.00

(6) # 15,000.00

TOTAL # 206,500.00

CONSTIGENCIES=5%

206,500.00×5%÷ 100

= #10,325.00

V. A. T = 7.5%

206,500.00×7.5%÷100

= #15,487.50

MOBILIZATION AND DEMOBILIZATION =10%

206,500.00 × 10%. ÷ 100

= #20,650.00

ACCOMODATION = 1.5%

206,500.00 ×1.5%÷100

= 3,097.50

TOTAL = 206,500.00

10,325.00

15.487.50

20,650.00

3,097.50

GRAND TOTAL = 256,060.00

SUMMARY

The Land Information System (LIS) for Asa-Dam Community Area integrated field surveys, geospatial tools, and multi-layered databases to address land management challenges. Primary data collection utilized Total Station instruments for precise coordinate measurements, while secondary data from Google Earth and historical maps enriched spatial context. AutoCAD and ArcGIS 10.0 facilitated the creation of thematic layers (e.g., buildings, roads) linked to attribute data such as land use type and construction year. Spatial queries demonstrated the system's utility in urban planning, identifying underutilized plots and zoning violations. A pilot-tested web interface enabled stakeholders to access interactive maps and reports, streamlining land allocation processes.

5.2 PROBLEMS ENCOUNTERED

The following were the problems encountered during the execution of the project;

- Minor inaccuracies in control point coordinates and fragmented cadastral records caused spatial errors and delayed data integration.
- Software incompatibilities required manual data adjustments during transfers between AutoCAD, and ArcGIS.
- Limited attribute data detail and stakeholder resistance hindered comprehensive analysis and data verification.
- Poor internet connectivity and insufficient security measures compromised real-time updates and data protection.

5.3 CONCLUSION

The LIS project achieved its core objectives by establishing a functional geodatabase and demonstrating its value in reducing land disputes and improving transparency. Key successes included layering techniques for efficient updates, spatial query tools for planning, and quality assurance protocols. However, systemic challenges-data granularity, minor accuracy errors, and stakeholder skepticism-highlight the need for continuous refinement. The system aligns with Sustainable Development Goals (SDGs) 11 (sustainable cities) and 15 (land stewardship) but requires sustained investment and community engagement to maximize impact.

5.4 RECOMMENDATION

The following recommendations are suggested based on the research on this topic:

- Improve data quality by acquiring high-resolution imagery and expanding attribute data to include ownership and tax information.
- Strengthen technical infrastructure through partnerships to enhance internet access and standardize software workflows.
- Promote policy support and capacity building by advocating for LIS legislation and training local users on system operation and data privacy.
- Enhance security and community engagement by implementing encryption, role-based access controls, and conducting awareness campaigns to build trust.

REFERENCES

Burrough, P. A. (2010). Principles of geographical information systems.

Dale, P., & McLaughlin, J. (2011). Land administration for sustainable development.

Enemark, S. (2014). Land administration systems: *Managing rights, restrictions, and responsibilities in land. United Nations Economic Commission for Europe.*

Foley, J. A., DeFries, R., Asner, G. P., Barford, C., Bonan, G., Carpenter, S. R., ... & Snyder, P. K. (2005). *Global consequences of land use. Science, 309(5734),* 570–574.

Goodchild, M. F. (2020). Geographic information systems and science (4th ed.).

Longley, P. A., Goodchild, M. F., Maguire, D. J., & Rhind, D. W. (2015). Geographic information systems and science (4th ed.).

Rajabifard, A., Williamson, I. P., & Kalantari, M. (2012). Spatially enabled government and society: *A global perspective.*

Seto, K. C., Güneralp, B., & Hutyra, L. R. (2011). Global forecasts of urban expansion to 2030 and direct impacts on biodiversity and carbon pools. *Proceedings of the National Academy of Sciences, 109(40),* 16083–16088

Ting, L., & Williamson, I. (2011). Land administration and cadastral trends: *The impact of the changing humankind–land relationship and major global drivers. Land Use Policy, 28(4),* 706–717.

United Nations. (2015). Transforming our world: *The 2030 Agenda for Sustainable Developmen*t.

Williamson, I., Enemark, S., Wallace, J., & Rajabifard, A. (2012). Land administration for sustainable development.

Zhu, X., & Wang, H. (2020). Blockchain technology application in land administration: *Benefits and challenges. Land Use Policy, 94,* 104531

APPENDICES

Appendix I : THE STATION DESCRIPTION

Appendix II : BOUNDARY COORDINATES

Appendix III : A PLAN SHOWING THE PERIMETER AND DETAILING

APPENDIX II

TABLE SHOWING BOUNDARY DATA

S/N	EAST	NORTH	HEIGHT	DESCRIPTION
1	668548.191	934980.009	331.811	Pt1
2	668547.444	934980.307	331.871	Pt2
3	668544.293	934982.894	331.784	Pt3
4	668544.636	934985.71	331.694	Pt4
5	668548.811	934982.607	331.897	Pt5
6	668552.283	934991.899	332.216	Pt6
7	668553.984	934993.093	331.953	Pt7
8	668558.627	935001.645	331.577	Pt8
9	668612.439	934967.966	333.403	Pt9
10	668607.837	934959.071	333.558	Pt10
11	668606.116	934957.957	333.569	Pt11
12	668601.641	934949.128	333.443	Pt12
13	668722.519	934871.483	335.622	Pt13
14	668723.124	934872.773	335.499	Pt14
15	668724.097	934869.82	335.661	Pt15
16	668731.395	934865.208	335.588	Pt16
17	668732.254	934866.8	335.747	Pt17
18	668741.023	934874.594	335.921	Pt18
19	668742.62	934875.863	335.869	Pt19

20	668745.124	934885.688	335.473	Pt20
21	668698.61	934743.591	339.35	Pt21
22	668689.78	934745.713	339.439	Pt22
23	668648.259	934630.293	341.776	Pt23
24	668646.292	934623.439	341.695	Pt24
25	668644.216	934617.787	341.771	Pt25
26	668651.595	934614.517	341.745	Pt26
27	668653.983	934620.525	341.743	Pt27
28	668656.616	934627.794	341.762	Pt28
29	668646.138	934631.747	341.464	Pt29
30	668615.759	934624.995	341.395	Pt30
31	668601.356	934630.677	341.566	Pt31
32	668590.349	934634.563	341.613	Pt32
33	668506.861	934663.579	340.036	Pt33
34	668508.229	934669.629	340.013	Pt34
35	668454.711	934686.553	339.446	Pt35
36	668452.802	934686.335	339.274	Pt36
37	668450.44	934680.815	339.423	Pt37
38	668443.943	934683.679	339.266	Pt38
39	668444.292	934689.11	339.17	Pt39
40	668440.342	934689.467	339.13	Pt40
41	668439.062	934684.378	339.26	Pt41

42	668477.787	934768.863	338.375	Pt42
43	668472.675	934772.053	338.535	Pt43
44	668501.603	934853.331	335.81	Pt44
45	668495.835	934856.335	335.789	Pt45
46	668503.845	934857.13	335.792	Pt46
47	668503.181	934853.4	335.868	Pt47
48	668520.586	934917.005	333.928	Pt48
49	668514.356	934919.536	334.031	Pt49