THE ROLE OF GEOGRAPHIC INFORMATION SYSTEMS (GIS) IN DEVELOPING SMART CITIES: A REVIEW

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ABSTRACT

GIS organizes the programming, hardware, and data required for a city to collect, organize, analyze, and present any kind of geology-related data. A city can see, analyze, and question data from several angles thanks to GIS innovation. Links, instances, and trends are easily visible in these GIS-based maps, reports, and graphs. In addition to enabling metropolitan regions to be more competent, GIS may play a significant role in empowering government interfaces where individuals can express concerns. Talk about the condition of the city's foundation and the corrective actions that the authorities have done. Additionally, participants may examine the city's innovative initiatives and provide input on the suggested development projects. This study demonstrates the use of GIS to improve urban community features in order to influence them to become remarkable urban settings.

Keywords: *Gis, Geographical Information System, Global Positioning System, Remote Sensing, Smart City.*

Introduction

A smart city is generally defined as an intense urban community that connects with the management of shared assets through participatory activity. This includes human, social, and traditional transportation, as well as modern (ICT) correspondence, framework, and reasonable monetary advancement. All of these factors work together to contribute to a high quality of life (Roulston, 2013). The idea is still being worked on as a fresh approach to managing and improving metropolitan areas. By combining urban planning frameworks, skillful administration conveyance, intense administration, energy management, and asset protection through the fundamental application of innovation and instrumentation, a clever city attends to the flourishing of the general public and produces social, financial, and long-term development. The goal of the Ministry of Urban Advancement is to support the development of urban environments that are competent, affordable, comprehensive, and economically lively. The goal is to create valuable urban foundations with guaranteed benefit levels and effective administration, in line with the mission and vision of advancing urban communities as engines of financial development (Lateh & Muniandy, 2010).

Globally, smart cities are a burgeoning wonder; there are thriving urban areas everywhere. In Asia, Europe, the Americas, and Africa, more than 2000 Smart City businesses have been launched or are in the planning stages. A study conducted in 2018 found that there were more than 1,7500 of these businesses, with an annual growth rate of 30% (van den Hoven, 2007). Among the partners are governments, municipalities, real estate developers, and other interested parties.Among the businesses participating are utilities, IT firms, engineering, architectural, and telecommunications organizations; infrastructure providers; grid providers; suppliers of building systems; and even automobiles.

Smart Cities and Geographic Information Systems (GIS)

One consequence of the transition to a sophisticated society that is strongly dependent on data is the rising political and financial significance of GIS, particularly in the last ten years. Although GIS are (basically) as ancient as human civilization, a plethora of new opportunities have been made possible by current breakthroughs in data and connection (Sretenović et al.,

2016). With great dedication, traditional geographers' work evolved into GIS, a rapidly developing important innovation for comprehending our globe and linked geospatial opportunities in order to promote a reasonable world. Examples of these advancements include software engineering, data innovation, remote detecting, cartographer's equipment for reviewing and planning, and so on.

For sustainable urban planning, development, and administration, GIS technology removes boundaries between distinct sections and acts as a coordinated cross-sectoral stage for acquiring, supervising, aggregating, investigating, and visualizing geographical, transitory data (Abdullah et al., 2010). The enormous respect and wide range of applications for GIS are undoubtedly causing some significant changes in the world we live in today. GIS was originally developed as a framework for gathering, storing, querying, analyzing, and presenting geologic referenced data. However, as web and mobile innovation have progressed, GIS has broadened as a term and a total bundle, which can refer to a variety of contemporary advancements and propel forms. GIS has also become more common, raising awareness of urbanization and its relationships (Khader, 2008).

Chiefs are increasingly using GIS as a vital tool for fundamental leadership development, surveying and creating sensible urban arrangements and smart locations to live, study, mix, and grow. In various areas of a taxpayer-supported institution, as well as in enterprises and industry, geographic information systems (GIS) are being utilized to give arrangements (Jepkorir, 2017).(Nasir et al., 2017). Geoinformation technology is being utilized in the assessing, constructing, organizing, and coordinating procedures for the gathering, managing, administration, and display of geographical data. The main justification for organizations investing in a GIS is the possibility of increasing proficiency. Better administrative data and transportation are only two examples of the new services that may be designed and provided to the public with the aid of these frameworks.

GIS components and composition elements A data framework is a group of methods connected to raw data sets that give information for fundamental leadership forums. Because the spatial component of the data is what associates it, the primary objective of all GISs is to provide basic leadership. Using spatial segments to check land use, natural resources, transportation capabilities, financial exchange, and other concerns is an optional goal (Code et al., 2021). In keeping with this, a GIS need to include many features that support the central leadership procedure. In addition to performing logical and illustrative technique, the framework should be able to store data, represent and regulate data, and carry out expectations and reenactments. The four basic components of a GIS are equipment, programming, information, and applications, together with their aspects. It's important to note that the product is divided into geodatabase, pro and essential programming shells, and geodata. According to Yaakup et al. (n.d.), there are two categories of configurations inside the geodata segment: specific and fundamental.

1.Software: The software elements of a GIS consist of mechanisms from:

-Data input and verification processes;

-Data storage and database management; -Data output and presentation;

-User interaction components; and an

-Operating system.

Hardware: The hardware aspect of a GIS consists of the following:

-Data input – digitalize, scanner, network elements, and keyboard.
-Data storage – disc drives, magnetic drives, optical storage.
-Data output and performance – screen, printer, plotter, VDU (visual display unit).
-CPU (central processing unit)
-User interaction – order input.

Data

The data that GIS manages, analyzes, and presents is an important aspect; the collection, organization, and presentation of data are essential to the plan's success. The collecting of geographical information requires a significant investment of time and money because to the high requirements for fulfillment, accuracy, and database structure. Spatial data often include geometric and thematic information (Latu, 2009; Singh et al., 2016). Geodata incorporates topological data, whereas current information only has a new format. Information concerning the surface of the earth is called geodata.It depicts the precise locations of all the components on Earth, such as the terrain and structure. Geodata may be connected to each other via these spatial references, providing the framework for further research and assessment. Applications-specific geodata and essential geodata are the two categories into which geodata may be separated. According to Milenković and Kekic (2016), they are called "topic information."

System Requirements for Geo-information A geoinformation framework's quality is determined by how well it can examine geographic data. This is a significant distinction between CAD-based frameworks and GIS and mapping frameworks. With GIS, clients may manage and access regulatory data (such as asset information, tax collection data, and geographic area, among other things).2010; Abdullah et al.; 2007; van den Hoven. The typical GIS practices and procedures are given here. retrieving content from a geographically directed database so that users may conduct feature-based searches for relevant information.

The word "regionalization" describes the (speculation and characterisation of spatial wonders). articles about space exploration (territories, removals in both relative and total space, etc.). integrated data analysis, or the geographic superposition of several points from compatible and non-harmonious models (layer idea). assessing your neighbors (e.g., catchment areas, challenges with area perception). analyzing the system (counting spatial measures) and the correlation. GIS is capable of managing and accessing enormous volumes of geographic data. There are a ton of insightful questions accessible. With effective information access, it should be feasible to conduct research on the area and associated spatial information aspects (Roulston, 2013). High levels of flexibility should be considered while designing the framework in order to satisfy the unique needs of a wide range of customers.

Smart Cities in Nigeria

The combined Abuja Geographic Information System would help with municipal administration, e-administration, ICT framework, and value-added administrations, such suggesting and implementing smart house plans and computerized ways of living for Abuja inhabitants. Abuja is known as the city of technology. The capital city will include entrance and movement sensors, bar indicators, touch-point computerization, and occupancy-based illumination (Sobeih, 2005).In addition to energy-efficient cooling systems—which eliminate the need for exposure to the elements—and innovative waste collection systems, the monitoring unit will have a headquarters in the major city from where it can immediately

respond to crises and oversee the complete IT setup.Normal routes will be diverted to the downtown area, and cars will be parked outside. Using PDA photos and GPS and GPRS technology, it maintains parks and road illumination and handles strong waste management, adding to the general public's space. Kaduna Utilities Company has an IT-enabled KGIS center and customer database; Abuja has a modernized building-design clearance process; Nasarawa has institutionalized property fee management via the use of geographic data frameworks (GIS).

Smart City Services using Geographic Information Systems GIS

According to van den Hoven (2007), perceptive cities can help approach makers manage and communicate geographical information by geographic region and integrate it with existing applications. This may be used to complex problems, like asset management, to visualize circumstances, increase knowledge, make better judgments, and collect and compress data across geographic regions, for example.Resource usage designs may be examined and visualised to track the evolution of benefits over time, identify patterns, and make more accurate predictions about what will happen in the future. Sophisticated sensor networks, sophisticated computation, and analysis are used in water management to help with more informed water strategy and administration choices. The Wrongdoing Counteractive Action compiles information from sales of the firm, including dispatch history, catches, and crimes or events.

Conclusion

This research provides many instances of dynamic urban communities in Nigeria in addition to demonstrating how the Geographic Information System (GIS) may be used to different structural design components. Urban and regional planners and arrangement designers now rely heavily on GIS, which rose from the classic cartography table and logical research institutes. GIS is an increasingly popular technique that may be used to optimize resource use in daily life; hence, it is an essential instrument for converting urban areas into Smart urban communities.Capital territory offers enormous advantages to both the government and the residents. Consistent GPS usage creates another store of accurate, consistent data that is then shown in different ways, requiring particular GIS expertise and attention.

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