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A SPATIAL DECISION SUPPORT SYSTEM APPROACH TO SUSTAINABLE PHYSICAL DEVELOPMENT PLANNING IN A BUILT ENVIRONMENT

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ABSTRACT

To make the MDGs a reality, especially as it affects the built environment, and to conform with the UN Agenda 21 and Habitat Agenda summed up in the concept of urban physical sustainability, there is a need to rapidly improve the quality of decisions on land use, conversion and urban renewal in developing countries, especially with regards to physical developments. The potentials of SDSS in determining optimum sites for physical developments within the built environment was the focus of this study. The SDSS developed took into consideration existing and future planning scenarios with the aim of creating a sustainable built environment. To do this, a framework for capturing existing landuse was generated and the SDSS used to generate physical development expansion scenarios of the Obafemi Awolowo University, Nigeria. The system facilitated integrated procedures for determining optimal sites for incremental physical development in such a way as to minimize impact on other aspects of development. The application of this system shows that planning especially as it relate to the urban environment can be made more flexible, dynamic and responsive to timely decisions on geographic space.

Key words: GIS; MDGs; Spatial Decision Support System; Sustainable Physical Developments.

INTRODUCTION

The growing recognition of the need to salvage the built environment of man, has be attributed to the wide spread problems militating against the achievement of the sustainable development goal of creating a livable human environment. The human environment, especially from the dawn of the industrial age, is increasingly becoming a relevant issue in man's continuous survival on the earth. One of the areas that has been most hit by series of human activities is the land. Most of man's interactions with his environment take place on the land. However because of the limited nature of land and its resources, it becomes imperative to develop a system capable of maximizing the use of land for physical development within the built environment.

Broadly defined, the built environment includes land use patterns referring to the spatial distribution of human activities; the transportation system referring to the physical infrastructure and services that provide the spatial links or connectivity among various human activities, and design features which refers to the aesthetic, physical, and functional qualities of the built environment, such as the design of buildings and streetscapes, and relates to both land use patterns and the transportation system that together provide opportunities for travel and physical activity (National Academies, 2005).

This definition implies that the built environment though delicate, but an integral part of the human environment has witnessed unprecedented use and re-use, hence the need for an efficient and rational action towards making it sustainable. Since resources are scarce and are fast diminishing, even as demands on them are on the increase, planning as an intelligent and rational form of decision making becomes inevitable as a means of reducing waste, of producing greatest return from the employment of resources and of ensuring efficiency in the utilization of resources to achieve maximum economic growth and national development.

However, because of the peculiar nature and importance of the built environment, planners around the world have emphasized the need to cater for physical development within the cities and other human settlement using the planning principles and concepts. The essence of this is to achieve a livable settlement described as ‘a welcoming, organized and comprehensible environment, where physical elements is unifying, accessibility within and without facilitate communication and promote interactions and flexibility, involving the design and development of buildings, circulation and service/utility system adapt to the needs of an evolving environment’ (Office of University Planning, 1997). Physical development planning which is concerned with the process of ordering the use of land and siting of buildings structures and communications to secure the maximum degree of economy, functionality, convenience, and beauty (Keeble, 1969) has, therefore, come to be accepted as a major area of planning because it encompasses all other facets of human interaction with land, including building engineering, mining or other operations in, on, over or under any land.

The above statement is vividly captured in the UN Agenda 21 and Habitat Agenda summed up in the concept of urban physical sustainability defined as an intervention to enhance the livability of buildings and urban infrastructure for all city dwellers, without damaging or disrupting the urban region environment (Adriana and Nicholas, 2002).

Need for Sustainability and the MDGs

The increasing stress put on resources and environmental systems such as water, land and air have been seen as not sustainable, especially as the world's population continues to increase (SD, 2007). The goal of sustainable development is therefore to enable all people throughout the world to satisfy their basic needs and enjoy a better quality of life, without compromising the quality of life of future generations. Sustainable development means a better quality of life now and for generations to come, that is, development which meets the needs of the present without compromising the ability of future generations to meet their own needs. It also means not using up resources faster than the planet can replenish, or re-stock them and joining up economic, social and environmental goals. In other words, sustainable development is maintaining a delicate balance between the human need to improve lifestyles and feeling of well-being, on one hand, and preserving natural resources and ecosystems, on which we and future generations depend (Toffel, 1997). Sustainable built environment or communities therefore implies looking after the places people live and work, for example, by developing green, open spaces and building energy-efficient homes. To achieve the desired result of sustainability for the built environment, proper physical development planning is crucial in the human geographic space. This is because physical development often involves huge resources and infrastructures. So to prevent huge wastes for now and the future, it is most instructive that physical development planning is done to produce optimum utility and benefits to the users. When available space is put to its optimum utility, revisions of land use usually become unnecessary and wastages are averted. But when revision becomes inevitable, it would be implemented without significant damage to other socio-economic infrastructures that may exist or that may be in the pipeline. This statement describes the concept of Sustainability.

For sustainable development to be achieved globally, the UN set eight goals to be achieved by 2015 as a response to the world's main development challenges and these goals are known as the Millennium Development Goals (MDGs). The MDGs are drawn from the actions and targets contained in the Millennium Declaration that was adopted by 189 nations-and signed by 147 heads of state and governments during the UN Millennium Summit in September 2000. The primary objectives of the MDGs are to synthesize, in a single package, many of the most important commitments made separately at the international conferences and summits of the 1990s; recognize explicitly the interdependence between growth, poverty reduction and sustainable development; acknowledge that development rests on the foundations of democratic governance, the rule of law, respect for human rights and peace and security; are based on time-bound and measurable targets accompanied by indicators for monitoring progress; and bring together, in the eighth Goal, the responsibilities of developing countries with those of developed countries, founded on a global partnership endorsed at the International Conference on Financing for Development in Monterrey, Mexico in March 2002, and again at the Johannesburg World Summit on Sustainable Development in August 2002 (UNDP, 2006).

Spatial Information and Sustainable Development

One of the goals of the MDGs, precisely the seventh goal, is to ensure environmental sustainability. To achieve this, information becomes a necessary tool. Since the major issues in sustainable development are resources and environment, the goal of the activities for sustainable development is therefore concerned with reasonable utilization of natural resources and effective ecosystems and environmental protection. Information on resources, ecosystems and environment becomes imperative for sustainable development decision-making. The implementation of sustainable development strategies should be based on scientific policy making, which demands great deal of real-time information. Therefore, it is one essential step to obtain real-time information and construct information systems for sustainable development. However, the peculiar nature of the built environment requires more than just any other information system but an information system capable of handling both the descriptive characteristics (attributes) and much more, the spatial component of this unique environment. This important feature is what a Geographic Information System (GIS) offers. GIS is a system implemented with computer hardware and software for the acquisition and verification, compilation, storage, updating, management and exchange, manipulation, retrieval and presentation, analysis and combination of geographic data (Benhardsen, 1992). Grimshaw (1994) stressed the relevance of GIS in decision making process when he defined it as a group of procedures that provides data input, storage and retrieval, mapping and spatial analysis for both spatial and attribute data to support decision-making activities of an organization.

In other words, GIS provides decision makers, especially those concerned with the built environment, ways of creating enabling scenarios for making timely and information-driven decisions to solve existing or identified spatial problems. A Spatial Decision Support System (SDSS), which is an extension of GIS, therefore, becomes more relevant to generate a more conducive decision making environment.

Spatial Decision Support System

Decision Support System (DSS) from which SDSS was developed, emerged as a computer based system that assist decision makers in semi-structured tasks, support rather than replace judgment and improve the effectiveness of decision makers rather than its efficiency (Morton et al, 1978). However, the need to handle spatial decisions led to the development of SDSS as a system capable of integrating spatial (geographical) information with computer based spatial analysis module, map analysis and display modules for tackling complex and ill-defined, spatial decision problem (Densham and Goodchild, 1989).

SDSS is, therefore, "an interactive computer-based system designed to support a user or group of users in achieving a higher effectiveness of decision making while solving a semi-structured spatial decision problem" (Malezewski, 1997). It is also a system that provides a framework for integrating analytical modeling capabilities, database management systems, graphical display capabilities, tabular reporting capabilities as well as decision makers' expert knowledge (Klinberg 1997).

Based on its characteristics, a SDSS is usually made up of (5) five modules:

- A database management system containing the functions of manipulation of the geographical database, that is, the module that stores the spatial data that will be used for the analysis.
- Model Base Management System (MBMS) containing the functions for model use and management. That is, the module that stores various models relevant to the application at hand and the parameters required to build such model.
- Dialogue generation and management system which manages the interface between the user and the rest of the components of the system (Armstrong & Densham, 1990).
- A report generator.
- Graphical User Interface (GUI), wherein the parameter for the models and queries are entered.

The development of SDSS further requires the setting up of three levels of technological development namely; the Specific SDSS which is a system being used to address a specific problem like retail location, the SDSS Generator which is a set of mutually compatible hardware and software modules used to implement the specific SDSS and SDSS Toolbox which can be used to build both the SDSS Generator and Specific SDSS.

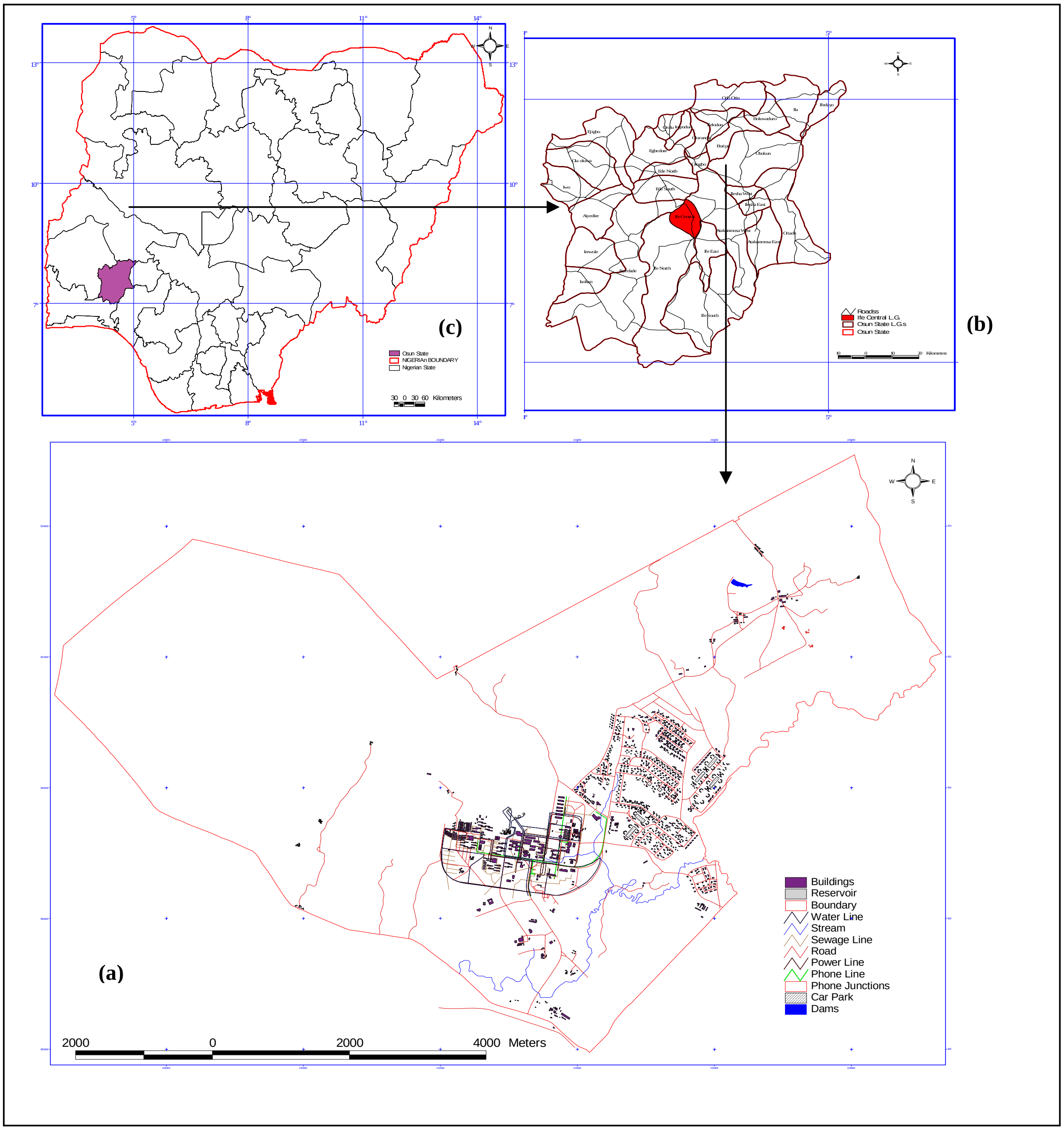
In bringing out it potentials, Malezewski (1997) described some of the features of a SDSS to include large number of decision alternatives, spatial variables of the outcomes or consequences of the decision alternatives, evaluation of each alternative on the basis of multiple criteria, the different preference with respect to the relative importance of evaluation criteria and decision consequences of the decision maker as well as the uncertainty nature surrounding the decisions. From the works of Malezewski (1997), Klimkenberg (1997), Power (2003), and other authors who have worked on Spatial Decision Support System, it has been established that SDSS generally is information dependent. According to Cowlard (1991), evidence in the form of information is one of the most critical stages of decision. By implication, therefore, absence of quality information (evidence/data) is a good reason for making wrong decisions (Wellar, 1990). According to Clarke (1995), one of the basic assumptions is that more information leads to better decision.

SDSS has been used in many areas of application. For instance, the ForestERA tool kit is an SDSS developed to aid stakeholders in developing forest management Scenarios and testing their cumulative effects on wild life habitat and fire hazard behavior (ForestERA, 2002). Dutta (2003) used Arcview enhanced Soil and Water Assessment Tool (AVSWAT) for land and water management applications to delineate watersheds for the purpose of estimating potential water, silt, and crop yield from each watershed. Nath et al. (2000), also employed a raster GIS as the basis for their SDSS in aquaculture management, while Ross et al. (1993) also developed a SDSS for assessing the potential of Salmonid Cage Aquaculture in a small bay of Canas Bruaciah Ruaidhe in West Coast of Scotland. Segrera et al. (2003) used AGDSSP for land planning in Cuba with specific application to Sugarcane. The Conservation Spatial Decision Support System (CSDSS) for Stone Forest landscape in Luman China by Zhang and Day (2001) is yet another area of application of SDSS. One of the SDSS that has been used directly for landuse planning was by Muity et al. (1990); it was a PC based infrastructure planning SDSS with sophisticated analytical capabilities to solve real world problems in public distribution of essential commodities, using resources network analysis and heuristic-based solutions under the realm of GIS technologies.

An efficient Spatial Decision Support System (SDSS) therefore uses geographic information to integrate procedures for determining optimal sites for incremental physical development in such a way as to minimize impact on other aspects of development, This conforms to the target action set by the UN for ensuring a sustainable built environment.

To implement this application, the Obafemi Awolowo University, which is experiencing rapid lateral expansion, was used as a model. This system allows development within the university to progress taking cognizance of the previous and contemporary development initiatives. In terms of its spatial extent, the university campus covers over 9,000 hectares of land lying approximately within longitudes 4^0 30’E and 4^0 34’E and latitude 7^0 29’N and 7^0 33’N. The university is divided basically into 3 zones, the Academic area which contains the facilities for the departments of the 14 faculties; the communal facilities such as the Central library, Amphitheatre-with restaurant and bar, Student Union-restaurant, club, bar, shops and offices, University Hall-administrative offices, bookshop, banks and post office; and the residential areas. Structurally, the Obafemi Awolowo University operates the segregated concept of housing development in which students’ and staff housing units are located on the opposite sides of the core campus made up of the academic and administrative areas. The students’ residential zone covers the halls of residence, cafeterias and the health centre. The other part of the school is the staff quarters for both senior and junior staff, the guest houses, conference centre, staff school and staff club. Recent developments on the campus is the in flock of new generation banks, expansion of government agencies and residential hostels especially those operated on private initiative of Built Operate and Transfer (BOT). Figure 1.2 shows the map of the study area as an inset of Nigeria and the state maps.

Figure 1: Maps of the Study Area (a), its Position in Osun State (b), Nigeria (c)



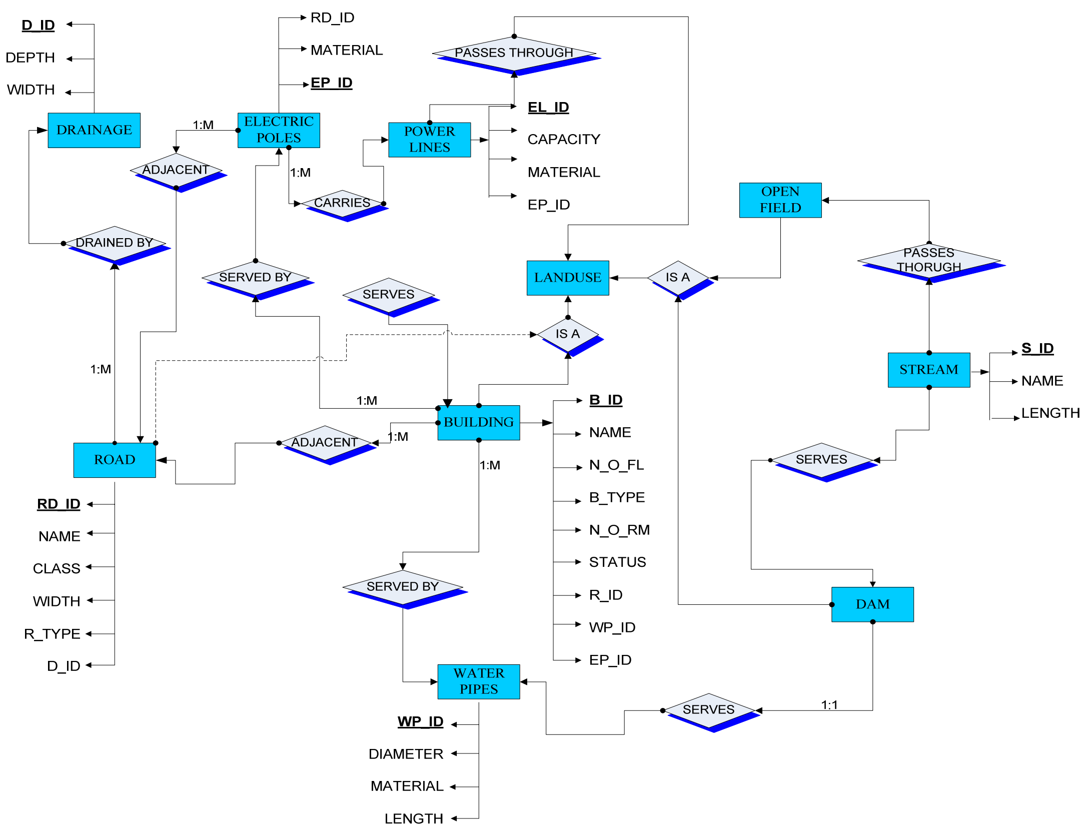
MATERIALS AND METHODS

Spatial Database Design and Creation

A database is an integral part of most SDSS and it's a self-describing collection of integrated records that models the user's reality. In this study, the three phases of database design were carried out namely; conceptual, logical and physical.

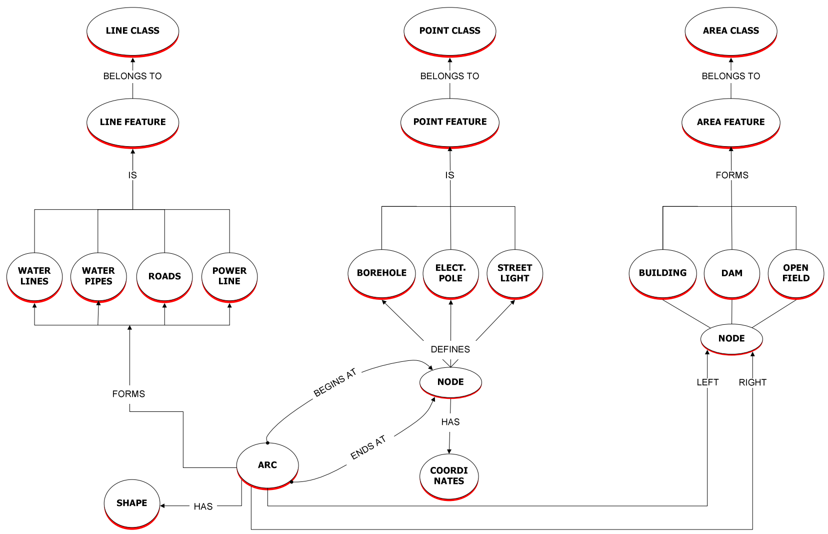
For the conceptual phase of the spatial database, various entities, relationships and constraints were created a high-level data model, i.e Entity Relation (ER) Diagram (see Figure 2).

Figure 2: The Entity Relationship Diagram Adopted for the Study



A 2.5D vector data model was adopted for the representation of the complex reality in this work. Basically, the vector data model represents the real world using points, lines and polygons or area in a 2.5D representation. Figure 3 shows the geometric representation adopted for this study.

Figure 3: Spatial Data Model for the SDSS



The logical phase translates the conceptual maximization into something more practical, perhaps simply thought of as putting numerical values into tables of data, but avoiding the details of storage of data on physical media. For this work, the conceptual schemas defined at the conceptual stage were translated into the data model of a particular relational DBMS. To do this, some simple transformation rules were followed by defining the relational schema with the Data Definition Language (DDL) (see Table 1).

Table 1: Showing Data Type for the Relations Used in the Study

RELATION	ATTRIBUTE	DATA TYPE	WIDTH	DESCRIPTION
ROAD	**R_ID**	Number	3	Road Identification Number
	Name	String	25	Road Name
	Class	String	10	Road Class ; Access or Major
	Width	Number	3	Average width of the Road
	Type	String	25	Nature of Road
BUILDING	**B_ID**	Number	3	Building Identification Number
	Name	String	50	Building name
	N_O_FL	Number	3	No of Floor/storey
	B_Type	String	15	Building Type; Storey or Bungalow
	N_O_RM	Number	3	No of Rooms in the Building
	B_Status	Strings		Present State (condition) of the building
	R_ID	Number	3	Road Identification Number
	WP_ID	Number	3	Waterline Identification Number
	EP_ID	Number	3	Electric Pole Identification Number
ELECTRIC POLE	**EP_ID**	Number	3	Electric Pole Identification Number
	Material	String	25	Material used for the poles
	RD_ID	Number	3	Road Identification Number
WATERLINE	**WP_ID**	Number	3	Waterline Identification Number
	Diameter	Number	3	Size of the pipe
	Material	String	15	Material used for the pipes
	Length	Number	3	Length of a pipe segment
ELECTRIC LINE	**EL_ID**	Number	3	Electric line Identification Number
	Capacity	Number	3	Voltage distributed
	Material	String	25	Type of wire
	EP_ID	Number	3	Electric Pole Identification Number
DRAINAGE	**D_ID**	Number	3	Drainage Identification Number
	Depth	Number	3	Depth of the Drainage
	Width	Number	3	Width of the Drainage

The physical phase is the last stage in the design and creation of the spatial database. At this level, the actual database schema that holds the data values were defined and it involved storage, access paths in which DBMS provides data access methods or access paths that accelerate data retrieval, query processing and optimizing and concurrency/recovery which guarantees security and consistency of the database.

Data Source and Pre-Processing

The bulk of the data required for this study was obtained from secondary sources including base map, landuse and utility maps of the study area and attribute data on some physical developments. These were obtained from the physical planning unit of the university. The secondary data were complimented by some primary data paramount of which are coordinate points of some prominent land uses within the obtained using Global Positioning System (GPS). Having acquired all necessary data, the following processes were carried out; the acquired maps were scanned as windows bitmap, referenced to their true ground positions, vectorised, and the output created as thematic maps in such a way that different layers (themes) were created. Lastly, the geometric data obtained from the operation above were linked to their attribute.

SDSS Implementation

In building the SDSS, some spatial analyses were carried out and they form the bulk of the GIS fed into the SDSS. The analyses performed included buffer which is one of the most important transformations used in GIS to identify all areas within a certain specific distance of an object (Longley et al., 2001). The buffer operation in the SDSS was carried out to create zones of interest around all identified landuse within the university and they were constructed as zonated buffers in which, the total distances of the buffer were segmented into rings of regular interval. Though an initial buffer of 50 meters interval was planned, a 200-meter interval was eventually used. This was because the number of zones created was too much for the high-end processing computer used for this project to handle.

The second spatial analysis performed was spatial overlay that combines two or more themes (layers) files, usually in preparation for further analysis. This analysis was carried out to integrate all the different landuse themes alongside their buffers using the overlay by intersection technique. This method of overlay uses the normal intersection in mathematical set theory to integrate the buffer of different landuse.

The next stage of the analysis involved the building of the Specific SDSS achieved by coupling all the data components generated in Arcview. This stage involved the actual implementation of the SDSS, that is, the designing of the Dialogue Generation and Management System. To construct the SDSS, a link between the GIS datasets created in Arcview and the Graphical User Interface (GUI) was carried out with the aid of the MapObjects LT 2.0a which is a set of mapping software components that let maps to be added to any application. The MapObjects served as an SDSS tool for building the specific SDSS. Taking advantage of the capability of map object LT to link with ESRI applications one of which is Arcview 3.2a, the software was employed using the Dynamic Link Library (DLL) to display maps with multiple layers, pan, and zoom through a map, draw graphic features, such as points, lines, etc., identify features on a map, select features within a specified distance of other features, and selecting features with Structured Query Language (SQL) expression.

The GUI was designed on two basic principles and assumptions. Firstly, it was structured in a way that allow for connection, interaction and interference. Secondly, it was designed in such a way to fit simplicity; since the end users may be policy decision-makers who cannot be assured to possess extensive computer knowledge. So, the system interface was made to be easy-to-understand and use, such that the user only need to input some values in text boxes created or click some buttons to access the result of any query.

Finally, all the different factors for site selection were built into the SDSS as parameters for different landuse and these can be integrated in such a way that potential sites can be selected. Factors for selecting potential sites for planning are based on criteria specified by professionals or decision makers and these criteria vary from one landuse to another

Testing the System

To test the system built, it was subjected to varying landuse planning scenarios based on standards. These standard, criteria or constrains are usually expressed in term of space which according to Obateru (2003), are land (space) specifications employed to guide the use and development of urban land use systems. The SDSS was developed in consonance with the space standards for physical development including roads, buildings, structures and erections, open spaces and objects of historical interests; sewage, drainage and sewage disposal etc. Another important aspect of the SDSS focused on site selection which entails sequential processes initiated with the conception of idea by a client to develop a site for a specific purpose, broad gathering of information and ends with specific detailed design drawings (Falade, 1998).

RESULTS AND DISCUSSION

In developing the Model Base Management System which was used to develop the SDSS for this study, the spatial analyses carried out in generated some results and these are discussed below:

The zonated buffer performed on all the identified landuse was done in such a way that it intersects with the university’s boundary. This was done to make all the parcels of land within the boundary potential sites for consideration in any planning decision. (see figs. 5a and 5b).

Figure 5a: Zonated Buffer of Residential Landuse

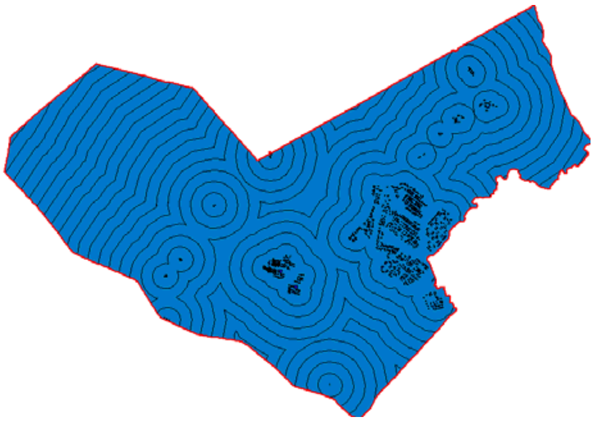
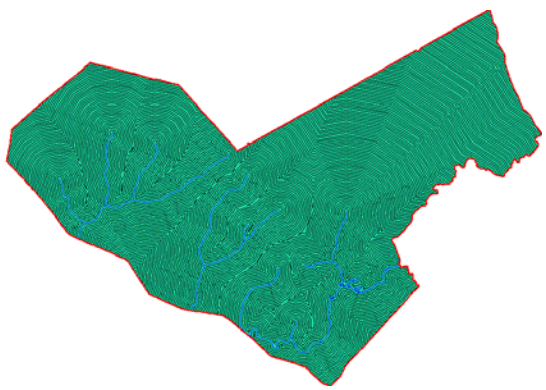


Figure 5b: Zonated Buffer of Residential Landuse



The zonated buffer enabled the selection criteria pertaining to a particular landuse to be made in such a way that in-between values (measure and distance) away from such object or target could be achieved. The implication of this is that gives SDSS the capability of selecting intermediate values especially when whole (single) buffer distance is not of interest, thus making the SDSS to adapt to changing planning criteria or parameter. For instance, fig. 6a shows different parameters at 200, 250, 300 and 350 meter distances/buffer (shown in yellow) for selecting a site suitable for constructing a new hostel building. This was however not possible using whole or single buffer (see Figure 6b).

Figure 6a: Query on Zonated Buffer at 100, 250, 300, and 350 Meters.

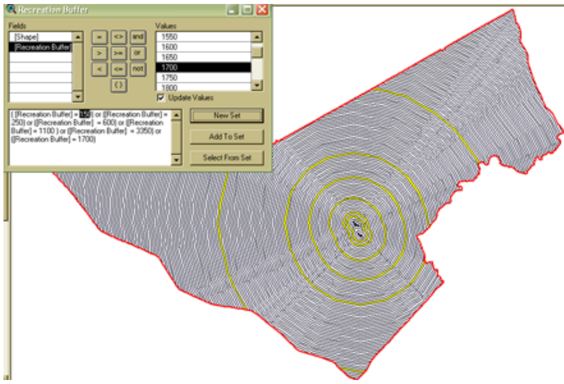
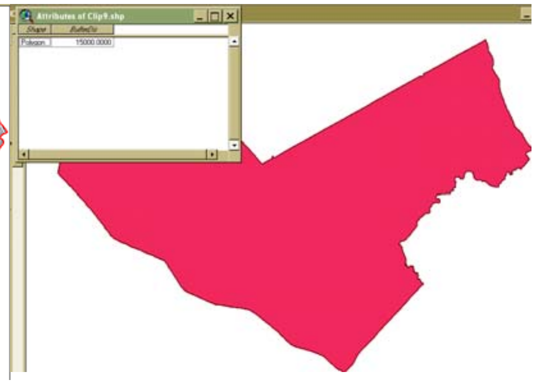
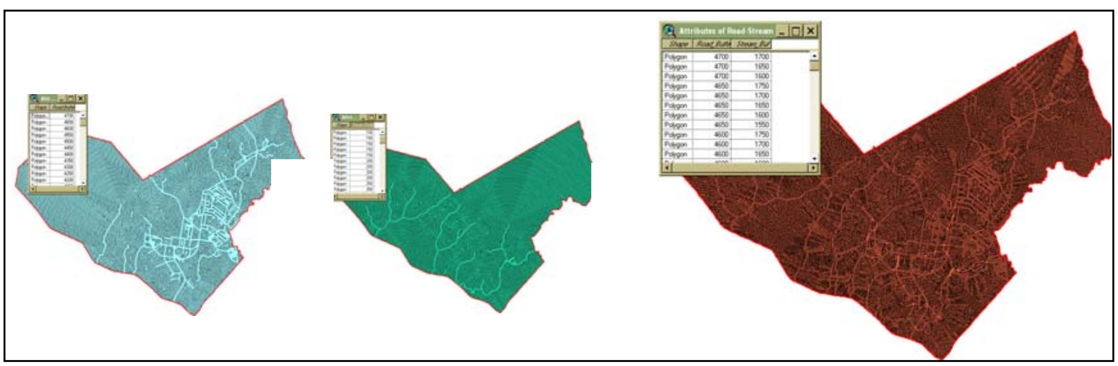


Figure 6b: Example of a whole (single) Valued Buffer



To have an integrated model in which all the data component have been tightly coupled, the overlay (by intersection) analysis was performed to integrate all the landuse themes and their buffers into a single theme called the landuse criteria (see Figure 7). This was done so that when a query involving common areas among the various landuse is given a solution may be obtained.

Figure 7: Example of the Overlay (Intersection) Analysis Performed to Integrate the Various Datasets



The internal layout of the SDSS can be previewed from the welcome page which displays the various aspects of the system (see Figure 8a). These can be accessed with the click of the mouse. The building search, road network, water pipeline and sewage line search components were incorporated to allow decision maker have direct insight into present physical development and be able to make timely information-driven decisions on future development. For instance, the building search can be used to find the location of any building within the university as shown in fig. 8b, while others except for the site locator, were designed for inventory mapping.

Figure 8a: Welcome Page of the SDSS

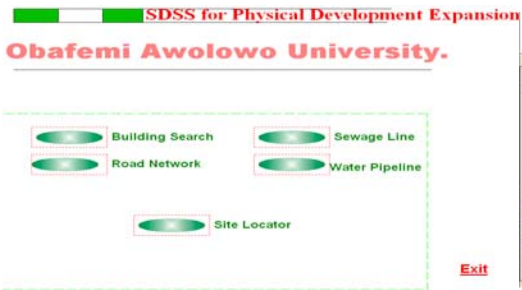
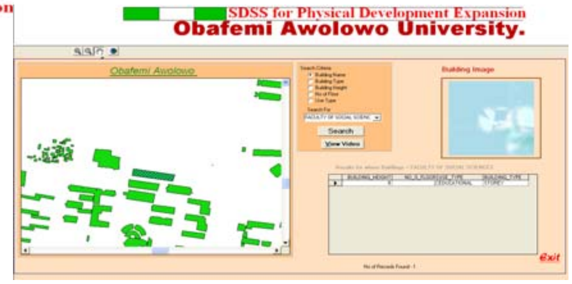


Figure 8b: Building Search Component of the SDSS



Taking into consideration the terrain factor of determining sites for physical development project, a digital elevation model (DEM) of the study area was constructed using coordinate values (x,y,z) obtained from the contour map of the university. This was used to generate a slope map of the university to compute the gradient of likely places that may be selected for new development project (see Figure 9a and 9b).

In implementing an SDSS, Daniel (1992) emphasized that in building the system, user friendly and interactive graphical interface that even a layman in computer must be used. To achieve this, the interface to all the components of the SDSS was designed to use buttons, icons and text boxes with capabilities for iterative queries and which the user can easily understand. Figure 10 shows the parameter entering mode of the SDSS.

Figure 9a: Slope map of the Study Area

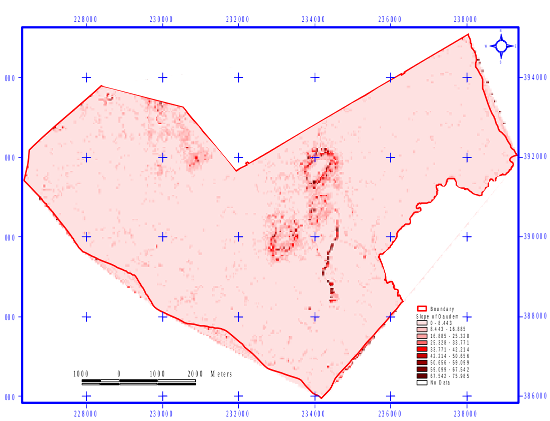


Figure 9b: Virtual (Areal) View of Part of the University

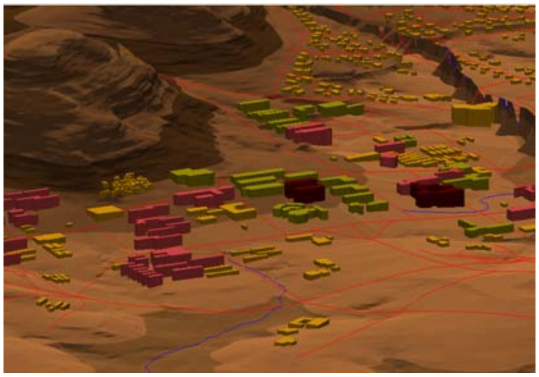
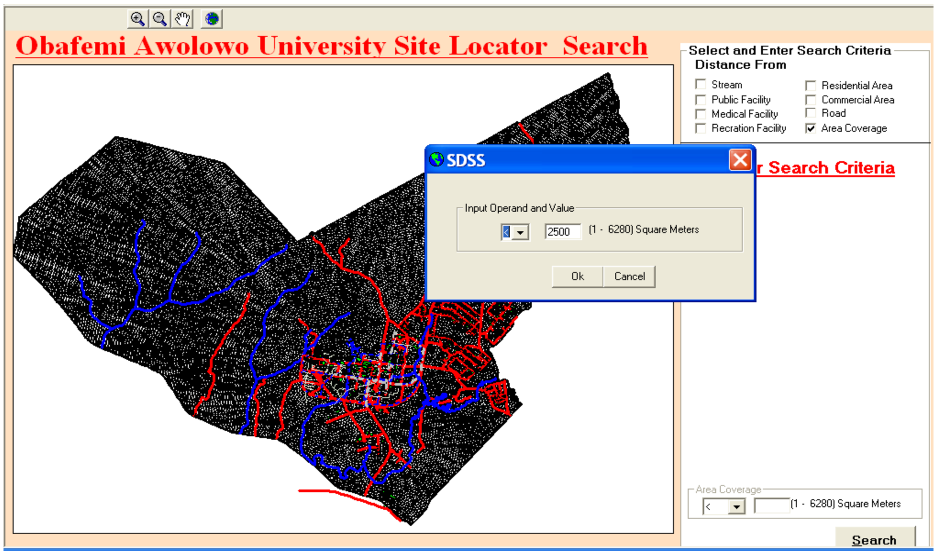


Figure 9a: The Interface for Entering in Planning Parameters into the SDSS



To test the workability of the system in adapting to different planning scenarios, all the different factors for site selection of different facilities and land use were built into the SDSS in such a way that their potential sites can be selected. Factors for selecting potential sites for planning were built into the system because of their significance in affecting the built environment, with respect to the spatial distribution of physical developments vis-à-vis their interactions with the environment. This module of the system was designed in such a way that different values can be specified for different landuse. The module allows the system user to type in numerical values representing the criteria specified by professionals or decision makers for the would-be facilities or structure. For instance, where the university need to construct a new hostel for a given student pop, it is possible to find suitable sites based on specified criteria. The criteria for such a siting may include the following highlighted in Figure 10a.

Figure 10a: Site Selection Criteria for New Hostel Building

- 300m away from existing commercial land use.
- 500m to all public facilities like religious centers and library.
- 300m distance to all flowing streams or water bodies.
- 250m from recreational facilities
- Area of $2500m^2$

Figure 10a: Potential Sites (in Yellow) for the New Hostel Buildings

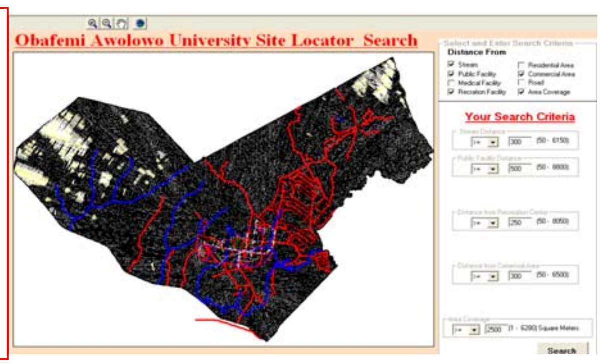


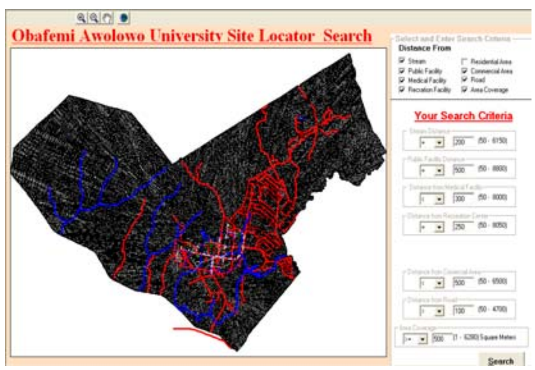
Figure 10b shows the result of the selection criteria tested for in Figure 10a. The potential sites highlighted in yellow were generated by the site locator module of the SDSS. This module works on the parameters specified in the text boxes by drawing from the spatial database that supports the system. The results are then displayed in the map panel. The displayed result can be zoomed and panned as required by the user.

However, because planning is often subjected to varying conditions depending on the need and the environment of the planner and the decision makers, it is possible to vary the selection parameters within the site selector without necessarily running the entire programme all over again. This can be achieved by returning to the text boxes for each landuse and inserting the new value. Subjecting the SDSS to a new set of parameters (Figure 11a), however, revealed that no site was selected. The implication of this is that there is no parcel of land that met the new criteria (see Figure 10b); hence, other parameters may have to be specified.

Figure 11a:

- 200m away from streams
- 500m from public facility
- less than 300m from medical facilities
- 250m away from recreational landuse
- less than 500m from commercial landuse

Figure 11b:



It is important to note that in physical planning, varying parameters can be set for the same project and this often than not may yield different results, depending on the planning conditions. The outcome from the different parameters set can then be evaluated using other non-conventional criteria, which may not be based on planning.

DISCUSSION AND CONCLUSION

The potentials of SDSS in determining optimum sites for physical development within the built environment have been demonstrated in this study. The SDSS developed took into consideration existing and future planning scenarios with the aim of creating a sustainable built environment. To do this, a framework for capturing existing landuse was generated and the SDSS used to generate physical expansion scenarios of the

Obafemi Awolowo University. The system facilitated integrated procedures for determining optimal sites for incremental physical development in such a way as to minimize impact on other aspects of development. The application of Spatial Decision Support System shows that planning especially as it relate to the urban environment can be made more flexible, dynamic and responsive to timely decisions on geographic space. The SDSS enables a faster and more flexible way of carrying out spatial search on features within the area of interest especially where a large expanse of land is being covered. For instance, a search involving a building, road or any other features can be performed within seconds and the results displayed either graphically, pictorially or as moving video. The results of the spatial analyses show among other things the need to refocus development in the urban built outside the core areas for efficiency and sustainability of the near balance between physical development and the natural environment.

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