GEOGRAPHIC INFORMATION SYSTEM (GIS) AND MANAGEMENT OF OFFICE/CLASSROOM SPACES IN NIGERIAN UNIVERSITIES: AKWA IBOM STATE UNIVERSITY EXAMPLE

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Abstract: *The study was conducted in Obio Akpa Campus of Akwa Ibom State University, Nigeria. The aim of the study was to establish staff office and class room spaces information using GIS support systems of generating, storing, analyzing and retrieval of such information. Education Trust Fund (ETF) office Block, Room16 and Social & Management Sciences (SMS) Lecture Halls Block, Room 9 were selected as samples of office and class room spaces respectively. Satellite Imagery of the study area was obtained from the 'Google Earth Company' using "Google Earth" software, version 5.0.11337.1968. The Image is dated 1/13/2014 and ground confirmations were carried out using the Garmin Global Positioning System (GPS) 72H model. The imagery was geo-referenced using Geographic Tie-point Coordinate approach in "Integrated Land and Water Information System (ILWIS) environment and ArcView 3.2 with Extensions, was used in the application. The study developed a system that makes it possible to identify office or class room block with just a click of button and the view of spatial and non-spatial office/class room details such as the room size, room capacity, ventilation, furniture, electrical appliances, equipment and mode information, year of installation, etc. The establishment of "Geographic Information Management GIS) Unit" in the Directorate of Physical Planning of the University was recommended.*

Keywords: GIS, Office spaces, Class room spaces, space information, management, Nigerian Universities, Akwa Ibom State University

1. Introduction

As the population of staff and students of Akwa Ibom State University grows, office and class room spaces would become more and more demanding. Also, as plans are underway to create new academic departments such as Geography & Environmental Management, Sociology & Anthropology, Banking & Finance in the Faculty of Social and Management Sciences, this may eventually lead to the holistic restructuring of the Faculty. Moreso, staff are being promoted from one rank to another, there would always be need for change and adjustment in the use of office and class room spaces. As the human mind can imagine and the experience of the few miniature cases of adjustments and changes that involved faculties of Arts and Social & Management Sciences, such change and adjustment can be a very complex and difficult task. Much time and manpower can be consumed handling such tasks manually (Daniel, 2005). Also, irrational and erroneous decisions could be made, with adverse consequences which may include wrong allocation of staff offices and class rooms. The effect of such poor decisions can generate conflicts, disagreements and refusals that may slow down the progress of academic exercises with attendant social and economic setbacks.

Office and class room spaces are among the most valuable economic and social resources in any institution of learning and it cannot be properly managed without an adequate system for the measurement and recording of the dimension, shape, ventilation, equipment, furnishing and occupier/user of such space. More importantly, such a system must ensure quick and easy access to the stored information. This study presents Geographic Information Systems (GIS) as an effective,

efficient and versatile system for the generation, storage, processing and accessibility of information on office and class room spaces in Akwa Ibom State University.

2. Statement of the Problem

Ability of any organization to manage its growth depends much on the availability of/and ease of access to adequate and versatile spatial or land information for planning, infrastructure development, equipment services, relocation, environmental protection and maintenance decisions. Unfortunately, the basic information on the staff offices and class rooms is in short supply and in the form difficult to access and analyze, thus rendering lopsided decision making process leading to inappropriate decisions. The consequences are usually confusion, delay, displacement of staff and disruption of academic activities in the University. The need for sophisticated space utilization/planning techniques to accomplish this complex task with ease of human effort thus arose.

3. Aim and Objectives of the Study

The aim of the study was to establish a system of staff office and class room information system using GIS support systems of generating, storing, analyzing and retrieving such information. To achieve the desired aim, the following objectives were set out:

1. to generate a digital spatial layout of staff offices and lecture halls in the University campus.
2. to design data base for recording and updating spatial and non-spatial data on staff offices and lecture halls in the University campus.
3. to produce an up-to-date GIS based spatial Plan of Staff Offices and lecture halls in the University.

4. The Study Scope

Obio Akpa campus of Akwa Ibom State University, Nigeria was selected for the study. This campus of the University is located at latitude $4^{o}58^{l}13.48^{ll}$ North and longitude $7^{o}45^{l}24.76^{ll}$ East . It is the second campus of Akwa Ibom State University after the main campus located at Ikot Akpaden, between Eket and Ikot Abasi along East-West highway in Akwa Ibom State.

Obio Akpa campus of Akwa Ibom State University is located along Abak - Ikot Okoro Road in Oruk Anam Local Government Area of Akwa Ibom State as shown in Figure 1. It has a sub-urban setting, adjoining Abak town and is within twenty minutes drive from Uyo. The campus hosts the faculties of Agriculture, Arts, and Social & Management Sciences. The study was specifically carried out on selected office and class room spaces of the faculty of Social & Management Sciences, the system, when fully developed could be used in planning and development of the entire University.

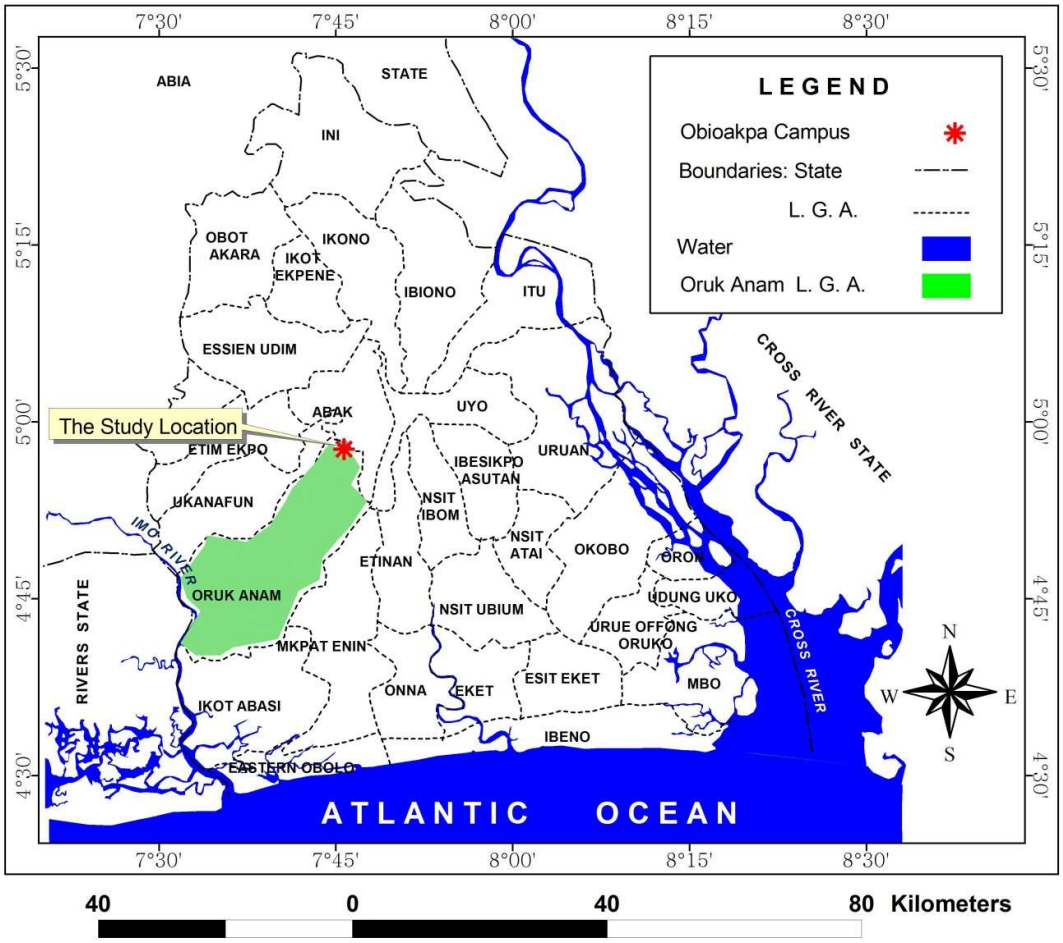

Fig. 1: The Location of AKSU, Obio Akpa Campus on the Map of Akwa Ibom State
[Source: Centre for General Studies (2017)]

5. An Overview of Geographic Information Systems

Modern GIS is an integrated system of computer software and data/information about the location and geography of things and phenomena and the relationships between them. GIS is used to interact with, manage and display geographic information. One of the earliest representations of spatial relationships and phenomena was the map of Victorian London, produced by Dr. John Snow in 1854 (Johnson, 2006) to represent the relationship between the location of cholera deaths and a water pump that he suspected of being the source of deadly bacteria during the 1840 London cholera epidemic. Snow produced the map showing the location of the Broad Street pump and other water pumps in the vicinity, as well as the points where each of the cholera victims died. By establishing that each of the residences that drew water from the Broad Street pump was also the location of a cholera death, Snow proved the source of the contamination. This is a wonderful early example of mapping spatial (location) and temporal (timing) relationships between things, in this case pumps and residences, and phenomena, deaths and drawing water.

GIS was first computerized in the 1960s (GIS.net 2010) as an effort to automate the landscape planning process of separating design influences, such as hydrography, vegetation, soils and ownership boundaries, into different layers. The approach before computerization was to draw each of the layers to scale on a separate page of acetate and then physically recombine them by stacking the pages in order to visualize different aspects of a proposed design. In the ensuing decades, GIS

has matured into an enterprise-class technology platform that allows users to model the spatial relationships between and among many important aspects of our complex world such as facility and space management, an application that this study attempts to make of GIS technology .

6. Facility and Space Management: Many facility management professionals are familiar with the acronym CAFM, which stands for Computer Aided Facility Management. Over the past few years, CAFM has become understood as a subset of Integrated Workplace Management Systems (IWMS) and is often described as Space and Occupancy (NSF, 1987). The primary driver in the growing discussion of GIS as a partner technology to enterprise applications, like IWMS, is a direct result of the market influences that drive the delineation between CAFM and IWMS: they apply and most often relate directly to the job functions of facility managers. The primary thread that connects these functions is spatial data, or location information associated with the area of interest of each function. If the users of an IWMS are concerned with constructing, managing, maintaining and / or leasing a space, the common denominator is the space. A space is defined at the most basic level by its boundaries and its location (Khemlani, 2004). However, each function must have access to a slightly different interpretation of the space. The potential for deriving benefit from combining the various perspectives on the space is substantial. Combining building automation systems (BAS) Spatial data is the primary thread that holds together functions such as project, space, maintenance, lease and portfolio management (Rich and Davis, 2015).

Facility and space management application user interfaces have traditionally been conceived as containing single floors represented as a flat, two-dimensional floor plate from which information is derived and on which various business processes or workflows are applied. According to Fallon (2008), space and occupancy management, space optimization and rationalization, departmental grouping and/or distribution are all business processes that are best served by a visual interface that spans the landscape. In city or region wide corporate environments, where there is a requirement for facility consolidation, the ability to thoroughly analyze the attributes of various locations can be a competitive advantage (NBIM, 2007). A competitive advantage can result by ensuring that the new location best serves the needs of customers, employees and suppliers. In a campus environment, the ability to see the distribution of departmental staff in three dimensions across multiple buildings can greatly enhance a Manager's ability to organize resources for the greatest productivity (Fallon, 2008).

According to ISO (2016), space management is the management of spaces – control and supervision of the physical spaces a business or organization occupies. This could be a single floor, multiple floors within a building, or multiple floors within multiple buildings. Space management is simple in concept yet far more complicated in practice. The practice of space management involves creating a space management system, and like many things in business, there are multiple ways to do this. A simple paper and pencil diagram could show the floor layout and room occupants, or an Excel file could contain the details about each space including occupants and resource usage. However, as organizations become more complex and as the need (even for small businesses) to cut costs and improve efficiency increases, these old space management methods are now becoming obsolete. Instead, facility managers are turning to computerized space management system to coordinate the management of spaces. Space management system makes the process easier, more accessible, and allows for additional capabilities such as space planning. It has become an ideal way for quickly and effectively implementing a space management system (IFMA, 1998). In this study, geographic information system was utilized to develop the space management system.

7. Benefits of Space Management

Why should organizations such as the university be interested in space management? The following are just a few of the many benefits for creating a space management system:-

i. To Understand Space Usage: The most basic benefit of a space management system is to understand how an organization is using its spaces. What spaces are occupied? Where are certain departments located? Who are the primary occupants of each room? The space management system helps understand where people are and how they use each space. It can also help hold specific departments accountable for the space and resources they use while simplifying the chargeback process (Mudrak, et. al. 2004).

ii. To Improve Space Usage: After understanding current space usage, one can then use space management system to optimize that usage and make the most out of the available spaces. Some ways of improving space usage include Identifying underutilized space; improving organization and design; improving interdepartmental efficiency (IFMA, 2016) .

iii. To Deal with Regular Space Changes: All organizations deal with a certain amount of hurn that could include moving certain employees or even entire departments throughout the facility space. However, with space management system, one can minimize churn and therefore the costs associated with movement. And if moves are required, the space management system can streamline the process from request to completion (ISO, 2016).

iv. To Plan for Future Space Usage: space management system helps plan ahead and predict future space usage. Space management system can be used to create forecasts of future space requirements and iron out all the details before it happens. Indeed, a good space management system can mean significant time and cost savings with a big boost to productivity in the university (FM: System, 2016).

8. Methods

Satellite Imagery of the study area was obtained from the Google Earth Company using "Google Earth" software version 5.0.11337.1968. The Image is dated 1/13/2014. Ground confirmations were carried out using the Garmin Global Positioning System (GPS) 72 H model. The imagery was geo-referenced using Geographic Tie-point coordinate approach in the "Integrated Land and Water Information System (ILWIS) environment. The geo-referenced image was thereafter exported to the Arc View 3.2 Extensions environment where the rest of the project tasks were done. The office/class room data were obtained from direct measurement and observation methods. Education Trust Fund (ETF) Office Block, Room 16 and Social and Management Science (SMS) Lecture Halls Block, Room 9 were selected as samples of office and class room space respectively.
The process of capturing the relevant data in the GIS involved the following:

1. Head-up screen digitizing.
2. Creation of Feature themes
3. Creation of Attribute Tables.
4. Adding of Data fields etc.

9. The Results and Discussion of Findings

The GIS application makes the identification of office or class room block possible just with a click of button. When cursor is on the desired block, click on it, the 'Identify Result" dialogue box pops up giving the identity of the building as shown in Appendices I and II .

In order to view the spatial details of a particular office/class room, zoom in using 'zoom in' tool and the results are as shown in Appendices III - XIV. A click on any feature in the zoomed office or class room space produces results of details on; room size, fixtures, furniture, et cetera (etc). One can also see detailed descriptions regarding the room, fixtures, furniture, etc in the 'Identify Results' dialogue box (see Appendices III – XIV).

As shown in the respective Appendices, the study has demonstrated the possibility of effecting change and adjustment in the use or occupier of any office or class room space within the office comfort without the rigors of moving round the facility spaces physically as presently the case. The study has enabled the visibility of the distribution of office and class room spaces across multiple buildings, thus enhancing the management's ability to organize built resources of the greatest productivity (Fallon, 2008).

Problem cases, such as electrical fault, electronic malfunctioning/breakdown, damaged fittings and fixtures in the university built spaces (class rooms, staff offices, laboratories, etc) can be attended to with dispatch as no time will be wasted in the effort to locate 'where'. This substantiates the argument of Rich and Davis (2015) that 'spatial data is the primary thread that holds together functions such as project, space, maintenance, lease and portfolio management.

The space management platform designed in this study has solved the problems that face the university facility managers. It helps to locate workers and access their details in seconds. One can effortlessly find the university resources and have their information available at a finger tips. It simplifies and streamlines the management of day to day relocations and large-scale moves, in real-time, using drag and drop features. Office/ class room space comes out of the box with analytical reports that will impact facility management decisions and operational reports that help improve facility management processes.

The space management system hereby developed will enhance the ability of the University management to manage its growth with ease of access to adequate and versatile spatial or land information for planning, infrastructure development, equipment services, relocation, environmental protection and maintenance decisions. The basic information on the staff offices and class rooms is available in the form easy to access, analyse and update as needs arise, thus rendering decision making process logical leading to uptimum appropriate decisions. The hitherto confusion, delay, displacement of staff and disruption of academic activities in the University will now be things of the past.

10. Conclusion

Remote sensing and Geographic information systems are effective instruments for data capture, processing and communication in the management of resources. It provides easy access to adequate and versatile spatial or land information for planning, infrastructure development, equipment services, relocation, and environmental protection and maintenance decisions. This technology can be adapted and applied in the management of the changes and adjustments in the use of office and class room spaces- a phenomenon that will constantly be experienced in Akwa Ibom State University and any other institution. It saves much time and manpower deployed in handling such tasks manually. Moreover, rational and sound decisions can be made with respect to office/classrooms allocation for the intended purpose. The effect of such sound decisions can reinforce the efficiency and effectiveness of the University's Management.

11. Recommendations

The GIS for planning, infrastructure development, equipment services, relocation, and environmental protection and maintenance require adequate monitoring and updating when sufficient change warrants that. Also, as the population of staff and students of the University grow, office and class room spaces will become more and more demanding. Also, as new academic faculties and departments are established new structures will be erected. Staff will be promoted from one rank to

another. These will always create need for change and adjustments in the use of office and class room spaces. The GIS will require updating to capture the changes in order to remain useful decision support base. To accomplish these tasks "Geographic Information Management" is recommended as a Unit in the Directorate of Physical Planning of the University. This Unit shall be headed by a trained and certified GIS expert who would coordinate the Unit's technical staff to regularly generate and maintain the University's land property data, and also evaluate and update the GIS routine review process.

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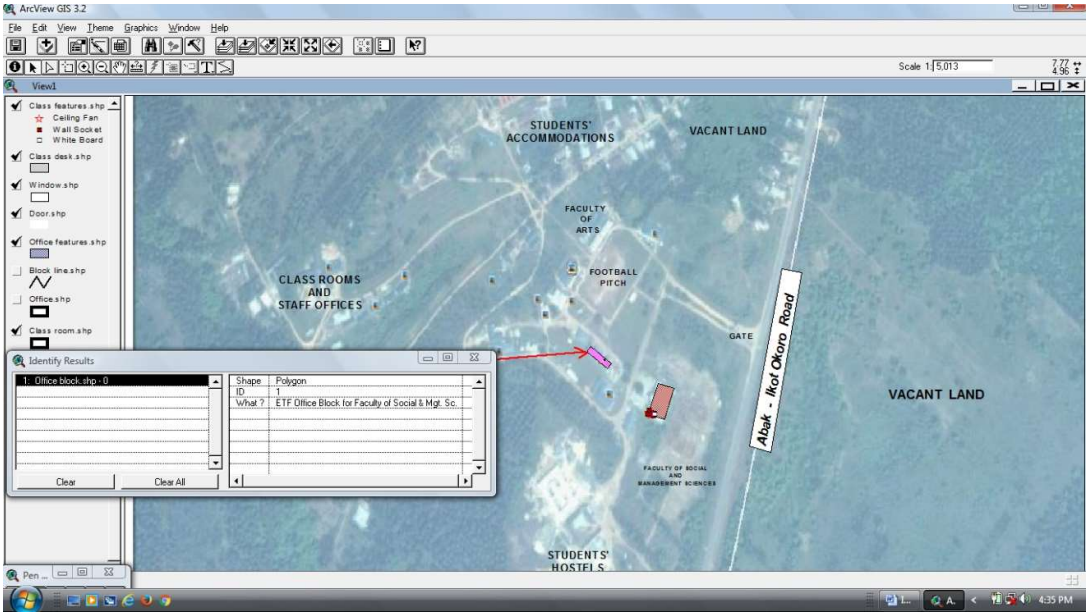
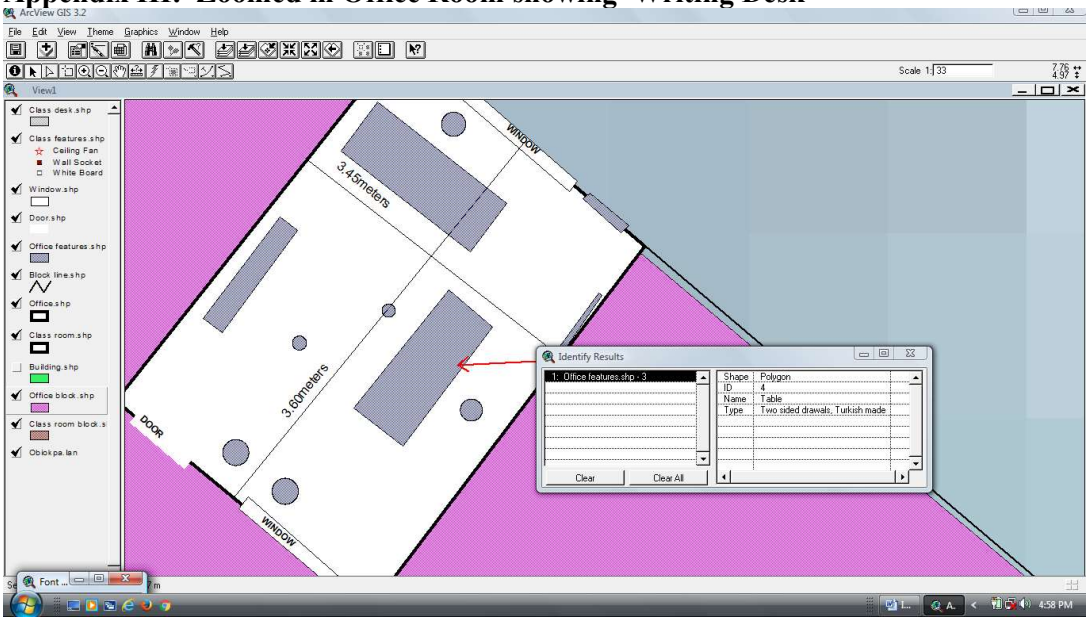
APPENDICES

Appendix I: Satellite Imagery Obio Akpa Campus showing the location of the selected SMS Class Room Block

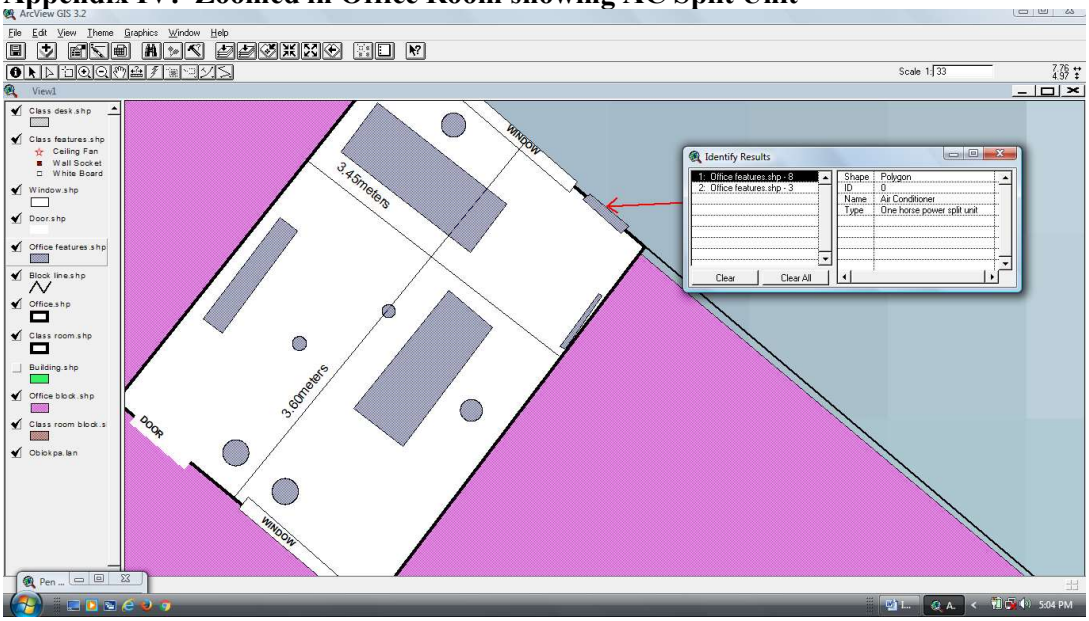
Appendix II: Satellite Imagery Obio Akpa Campus showing the location of the selected ETF Office Block



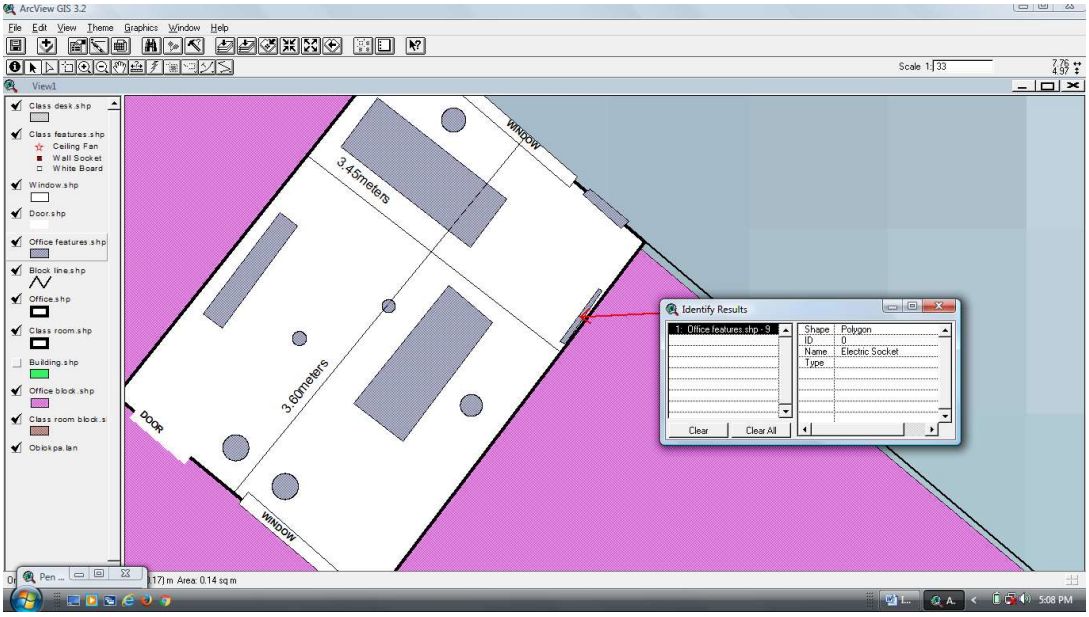
Appendix III: Zoomed in Office Room showing Writing Desk



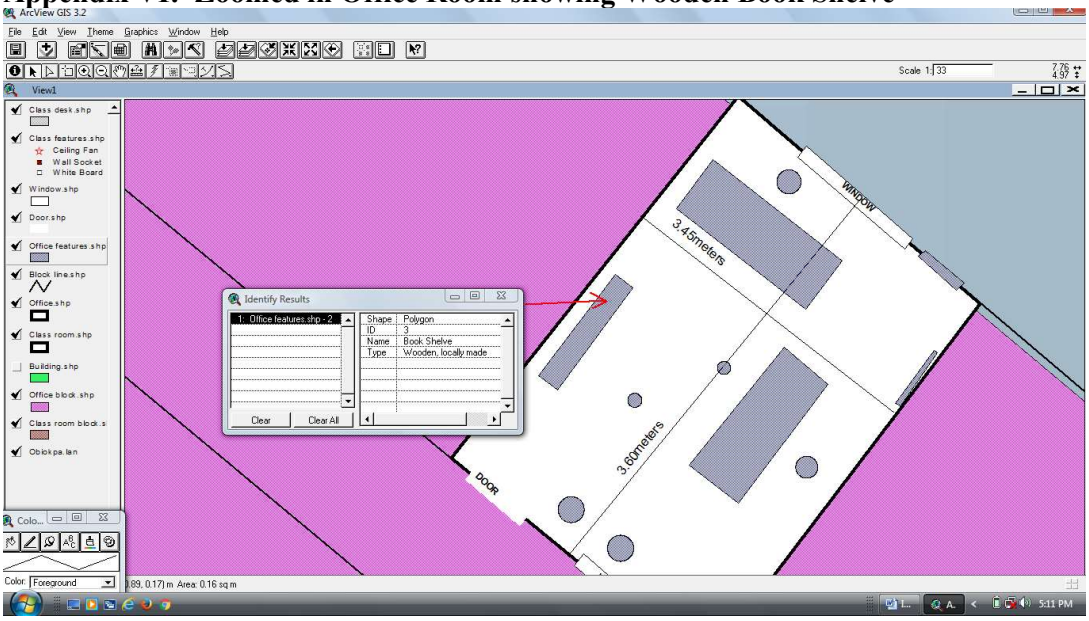
Appendix IV: Zoomed in Office Room showing AC Split Unit



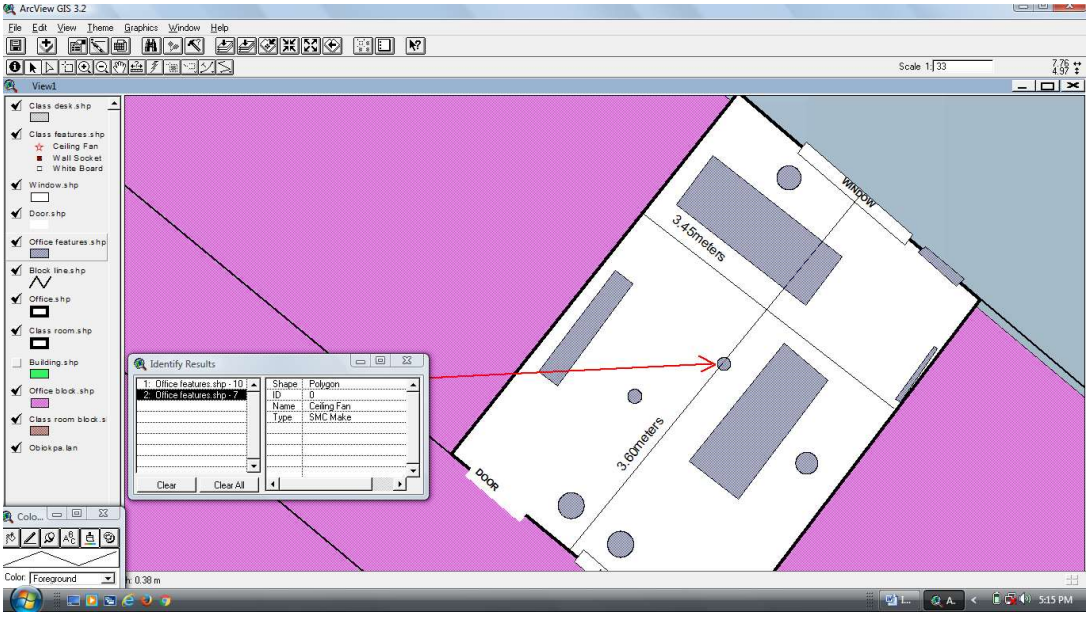
Appendix V: Zoomed in Office Room showing Electric Socket



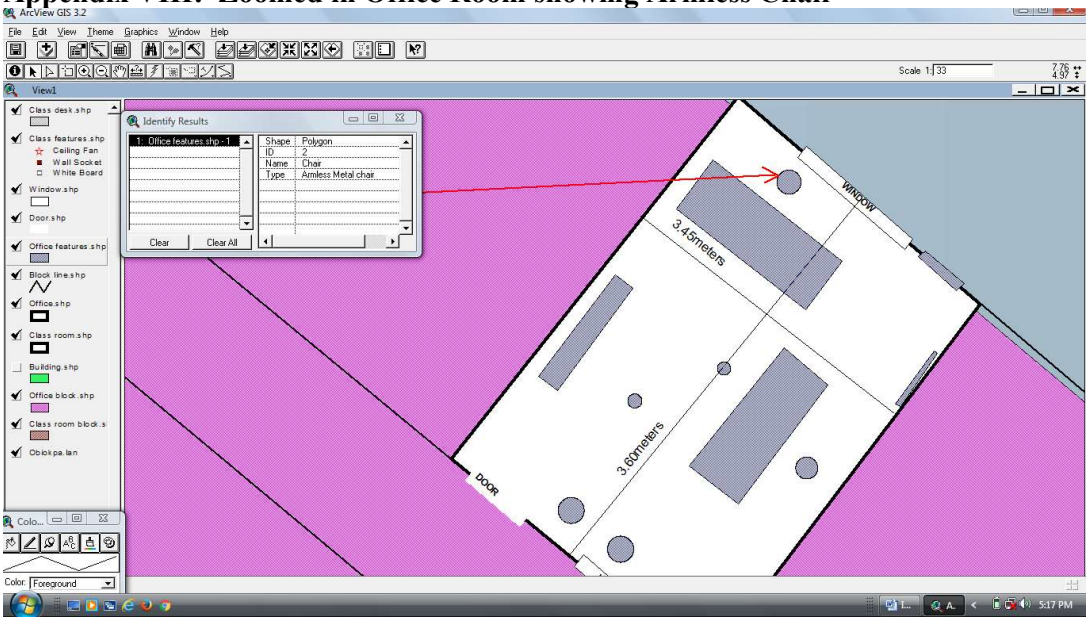
Appendix VI: Zoomed in Office Room showing Wooden Book Shelve



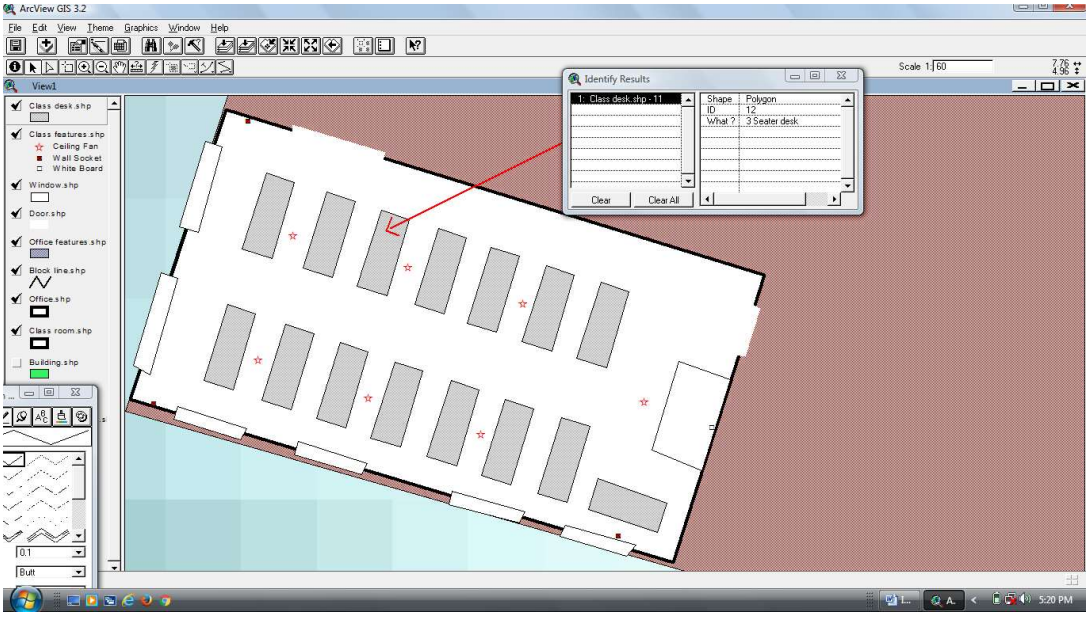
Appendix VII: Zoomed in Office Room showing Electric Ceiling Fan



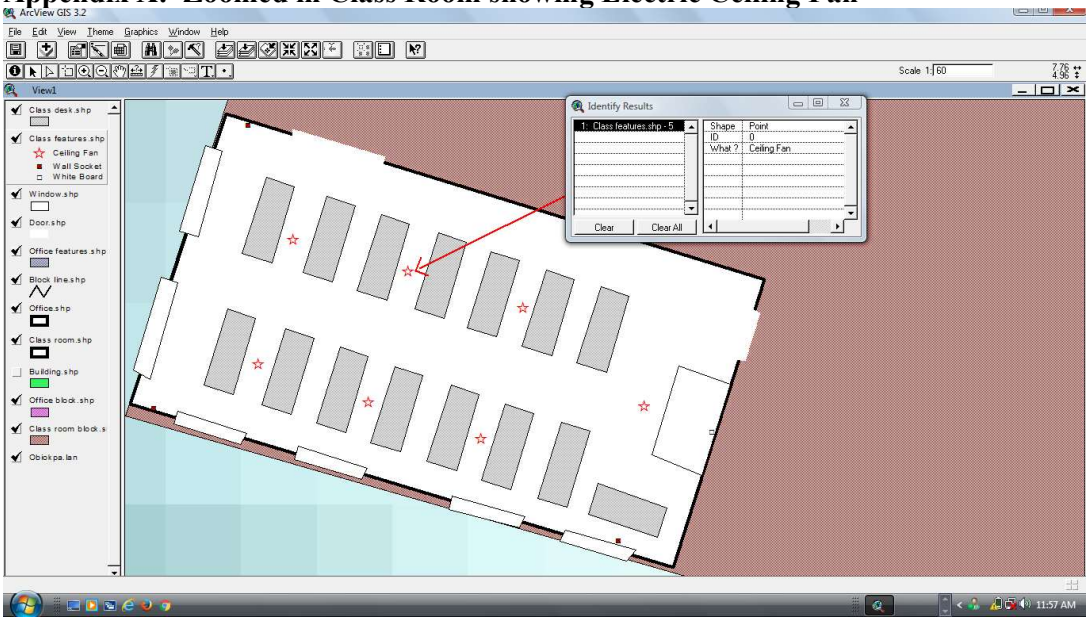
Appendix VIII: Zoomed in Office Room showing Armless Chair



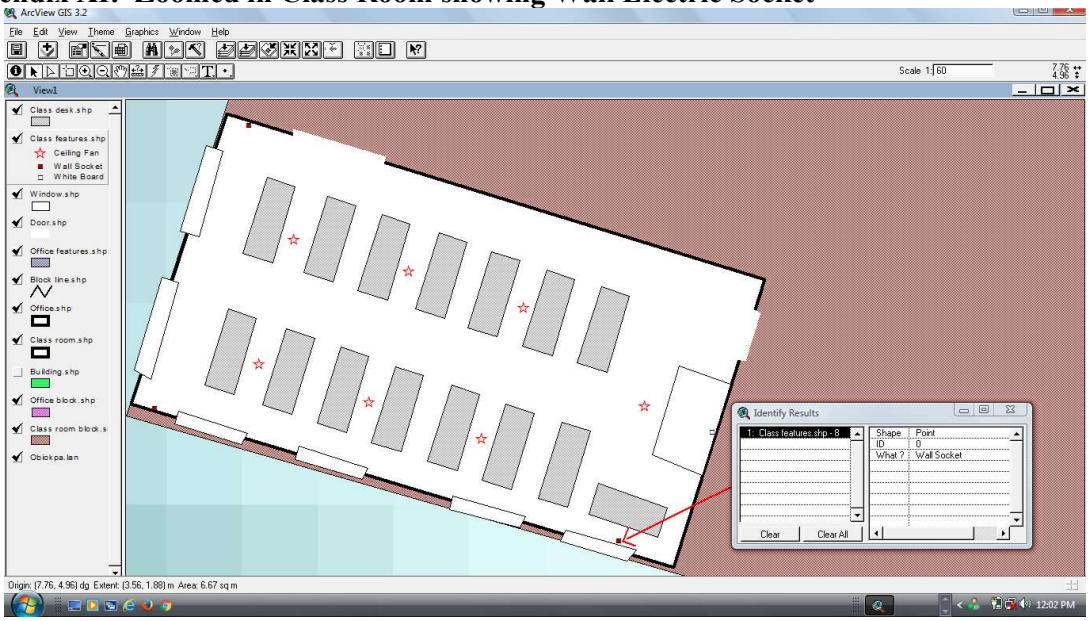
Appendix IX: Zoomed in Class Room showing 3 Seat desk



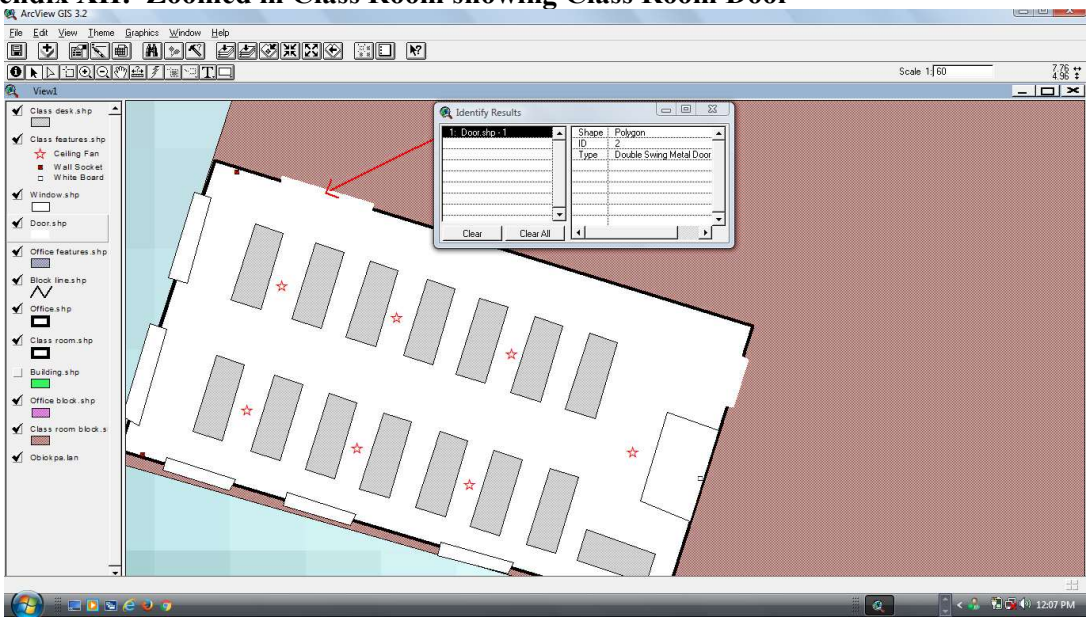
Appendix X: Zoomed in Class Room showing Electric Ceiling Fan



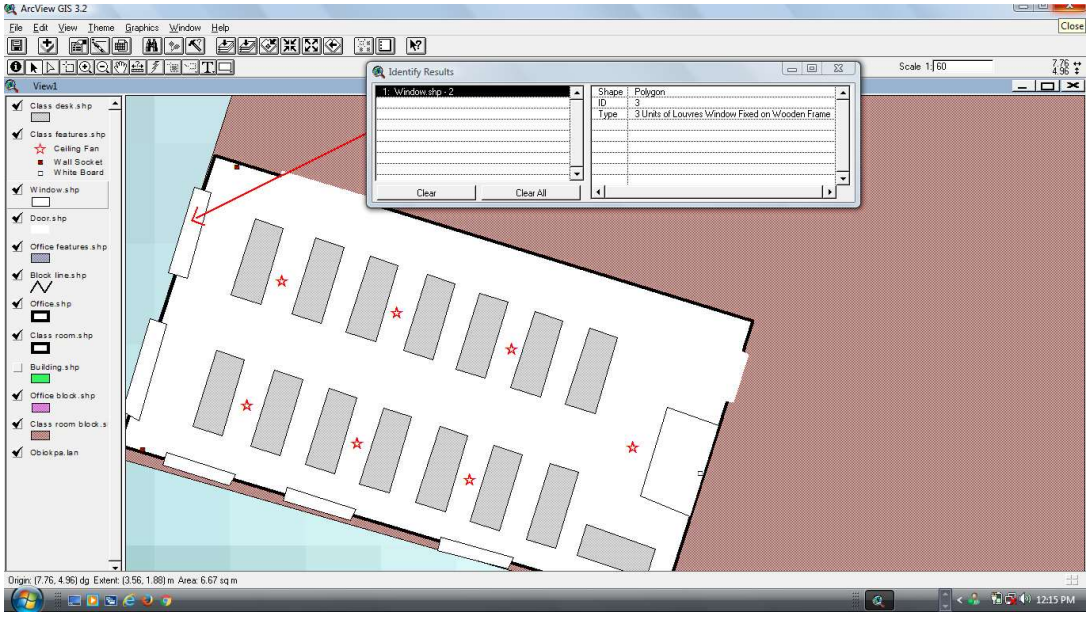
Appendix XI: Zoomed in Class Room showing Wall Electric Socket



Appendix XII: Zoomed in Class Room showing Class Room Door



Appendix XIII: Zoomed in Class Room showing Louvres Window



Appendix XIV: Zoomed in Class Room showing Wall Mount White Writing Board