

Geospatial Modeling and Analysis of Electricity Distribution in Ngozika Housing Estate Phase 1 Awka Anambra State, Nigeria.

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Abstract-This paper reviewed the capability of using geographic information system (GIS) to manage Electricity distribution for effective functioning of the entire scheme. Electricity distribution were traditionally done by conventional surveying method using analogue equipment. Recently the availability of fast computer, digital data acquisition technology and digital data processing along with information presentation technology have brought a revolution into Electricity distribution through application of GIS. The aim of this paper is to demonstrate how Electricity distribution can be model using GIS techniques. This was achieved through the following objectives: Acquisition of base map of the Study area, Digitizing the acquired map and showing new and existing electrical features (transformers and electric poles) as well as major structures as well as demonstrating through various analyses the potentials of GIS in the Electricity distribution of Ngozika Housing Estate Phase 1. The methodology adopted in the execution of the project included: Acquisition of primary and secondary datasets in the study area. During ground truthing identified Electrical features were collected and placed on the map with additional information gotten from the existing Electricity distribution information. The research work was based on computer interpretation of geospatial models using Microsoft and ArcGIS 9.2 software.

The result of the analyses which include various queries and buffers will enable management to make good and effective decision on electricity distribution. The database gives management enough information on the inadequate infrastructure maintained, which is vital to continuous functioning of installed facilities. It is therefore recommended that GIS technology should be adopted in Electricity distribution, geospatial Electricity distribution database and model be posted on the website for potential users amongst others.

Keywords: Database, Electricity Distribution, Geospatial Modeling, GIS

I. INTRODUCTION

The utility system made up of water and electricity could be run for benefit of workers and other resident of a community such as campuses, residential districts, autonomous communities and metropolitan areas invariably, there should be records as regards their installation at different points in time as evidence by the relevant utility mapping. There should also be a spatial

inventory of electricity and water distribution systems and their representation to digital map form at an appropriate scale. Since these distribution systems are either over head or underground. It makes their mapping very essential with additional information on their relationship with other features. With this been said it is important to map the electricity distribution in Ngozika Housing Estate Awka Anambra State, as the estate is plagued with Improper Documentation, little or no maps depicting electricity distribution, analogue method of data storage which makes search difficult and no proper location description of transformers and other electricity distribution cables etc.

II. STUDY AREA

Ngozika Housing Estate in Awka the capital of Anambra State was the chosen are for the study. It is located between latitudes 6°06'N and 6°16'N and longitudes 7°01'E and 7°10'E. It lies within the topical rainforest zone of West Africa. It comprises Awka South and Awka North L.G.A. The average relative humidity is 80% the mean daily temperature is 20°C while the mean annual rainfall is 200cm

III. METHODOLOGY

The methodology adopted in adhering the general goal of this project included.

1. Planning
2. Data Acquisition
3. Data Processing
4. Geospatial Analysis and Query (Spatial Data Creation)

A. Planning

Planning involves marking adequate preparation and taking decision that will facilitate the realization or attainment of set of objective. Hence the Hardware, software and other important material needed for effective execution of the project was extensively considered.

- (1) HP Intel Pentium Laptop with 2.5GHZ processor with 350GB hard drive and 4000MB RAM.
- (2) External or transferable device such as CD DVD Reader or writer.
- (3) Ao Scanner
- (4) A4 Scanner
- (5) HP office Jet K7103 coloured printer

B. Software

- (1) Microsoft office packages such as Microsoft word, Microsoft access, Microsoft Excel and note pad.
- (2) Window XP Professional Operating System.
- (3) Arc GIS 9.2 use for spatial data storing, manipulating, analysis, displaying and queering.

C. Data Acquisition

Acquisition of Existing Spatial and attribute data other maps, either in digital or hardcopy format was acquired from individual, private firm (such as a private practicing surveyors, Anambra State Housing Co-operation. All Cadastral Information of existing block was acquired from Anambra State Housing Co-operation.

The spatial data was imported into Arc GIS 9.2. The projection and co-ordinate system (such as georeferencing of survey plans was also considered before digitizing the cadastral plan. The attribute data was obtained by the focused group interview technique or questionnaire. Several questions was asked during the presentation aimed at answering both the objective the study.

D. Database Design

The creation of a structured, digital database is the most important and complex task upon which the usefulness of the cadastral information system depends. Database design is the process of producing a detailed data model of a database (Hernandez, 2012). The design phase consists of three levels (Kufoniya, 1998):

- a. Conceptual Design
- b. Logical Design
- c. Physical design

1. Conceptual Design

This is a representation of human conceptualizing of reality of the entire information content of the database. Here decision on how the view of reality was presented in a simplified manner and to the satisfaction of the information

2. Logical Design

This is another stage of the database design in which all the real world entities conceptualized were modelled into the real world using logical design. It is the representation of the conceptual design to reflect the recording of the data in the computer system using a relational database management system (RDBMS) (Effiong and Alagbe, 2012). In this phase, the entities, their attributes and their relationships were represented in a single uniform manner inform of relation in such a way that would be no information loss and at the same time no unnecessary duplication of data. For this study, relational data model was used due to its easy implementation and management. The conceptual data model developed in this study was translated into the relational data structure. In the relational data model, data are separated into tables. They are found along rows and columns. The conceptual model was translated into a logical structure and the following relations were derived.

3. PHYSICAL MODELING PHASE

This is the phase where the data structure is translated into built-in data of the chosen software. Nowadays, GIS software dictates most of the physical database design activities. The physical database design for each spatial entity has been completely defined by the vendor and the GIS designer does not have to do anything more for this part of data

IV. RESULTS

Results of database queries were presented inform of digital maps, graphics, reports, photographs and tables (see appendices). The maps can also be thematic in nature.

These presentation can be in hardcopy, softcopy and onscreen. The results of analysis discussed below are what was conveyed to people who make decisions about resources.

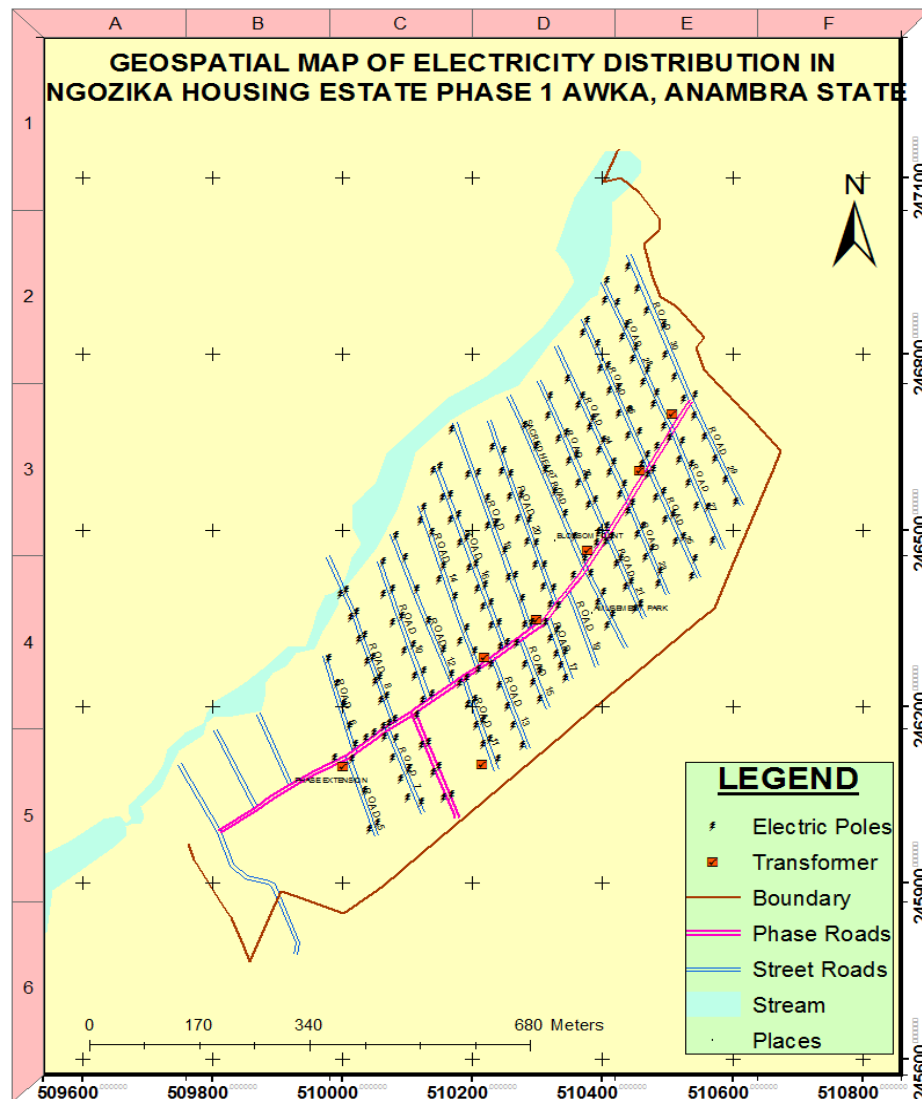


FIG 4.1: Geospatial Map Of Electricity Distribution In Ngozika Housing Estate Phase 1 Awka, Anambra State.

The figure above shows that totality of the project. This is the end result of Geospatial Electricity Distribution in Ngozika Housing Estate Phase 1 Awka, Anambra State in which different information are display on the map which can be easily identified through the use of the map's legend. Such information are the Boundary line of the Estate, the two different type of roads found in the estate

(Phase Roads and Street Roads), the stream, the major items for this project which is: the transformers and the electric Poles etc. it also carries the grids that is the coordinates in which the features in the map falls in. two type of grid was used for easy identification, they are: Graticule and Index types of Grids.

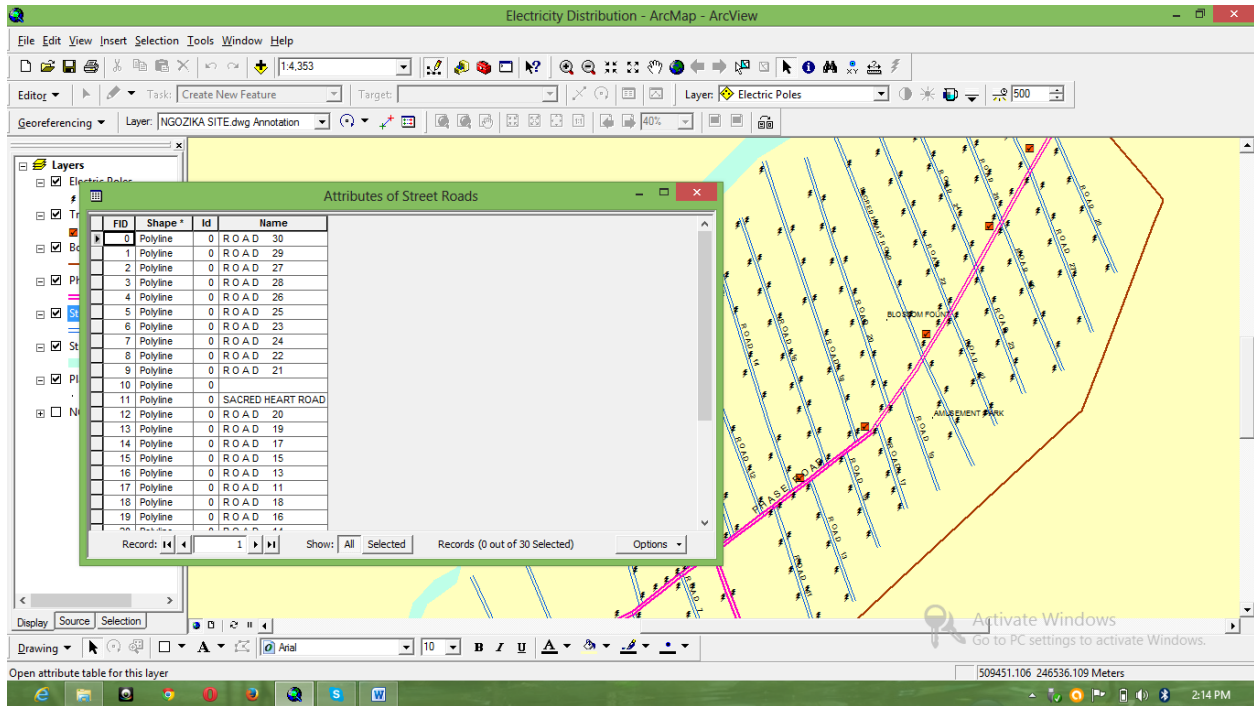


FIG.4.2: Attribute Query Result within the Study Area.

This figure shows the attribute query result which contains the different information attached to features such as the name of the road (road no), geometric type (polyline) e.t.c.

With this one can know what a particular feature look like without seeing it physical.

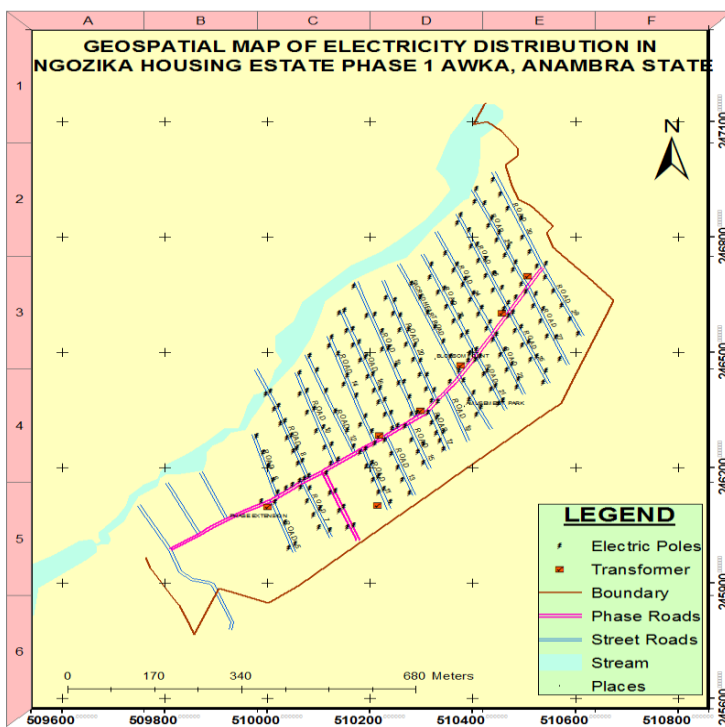


Fig. 4.3: A View Showing An Image Hyper linking Of Transformer Within The Study Area.

This figure simply shows one of the potential of GIS. In this one of the transformer which is in the study area is not only shown together with the rest of the features in the study area. The point geometric type used for transformers

is also displayed on the legend together with other features geometric type used. The image/photo of the transformer is also display which helps for easy identification on ground and beautifies the work.

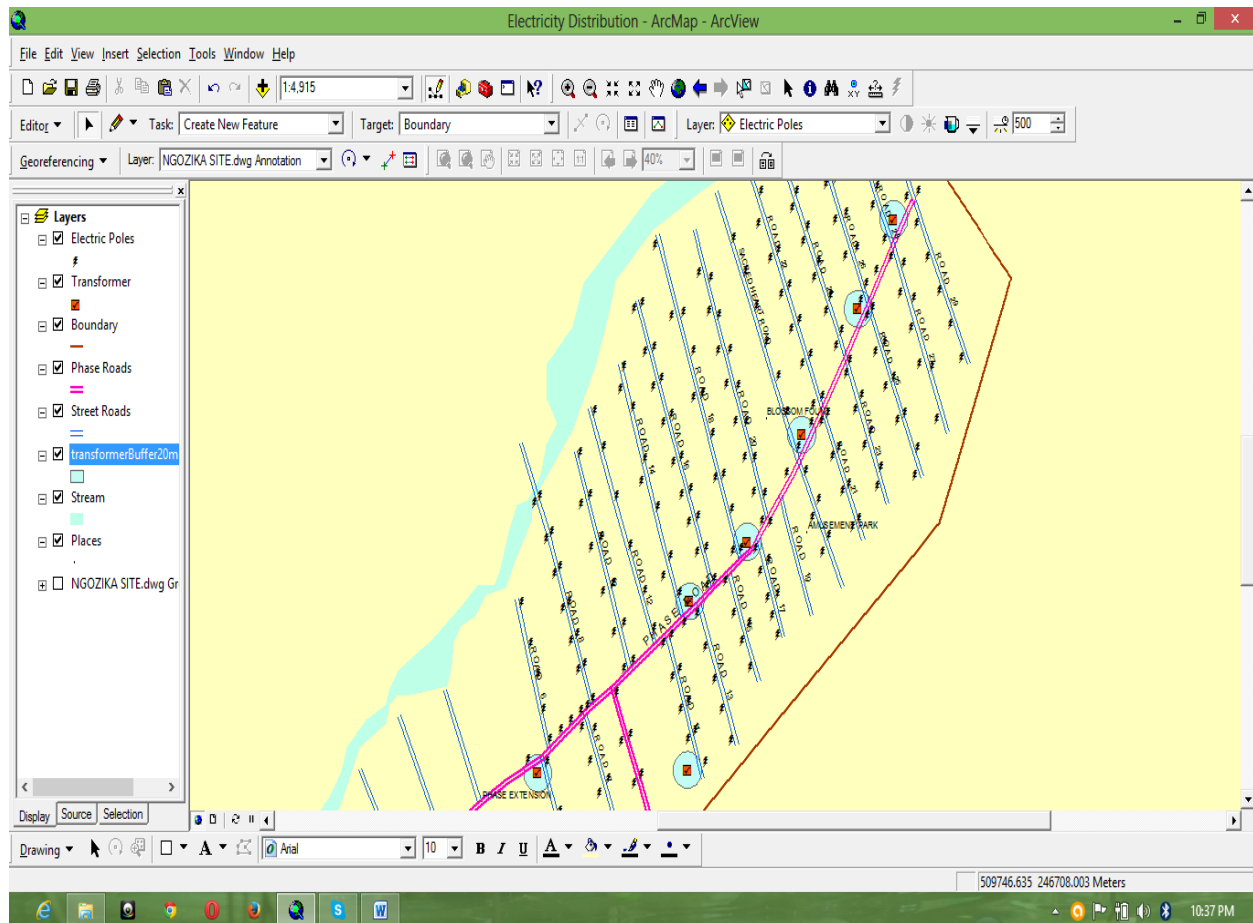


Fig. 4.4: Route Analysis Query Within The Study Area.

One of the main Spatial analysis carried out in the course of the project is the proximity analysis. This can also be referred as Buffering. Buffering is simply the zone of influence of any action on a feature. In the figure above the transformers were buffered to 20meters around it. In a case of fire outbreak on a

transformer and the effect of the fire is said to be 20meters around it, the spatial analysis known as proximity analysis (buffering) can be carried out and the affected areas will be displayed on the map on the screen without the user going to site to see it.

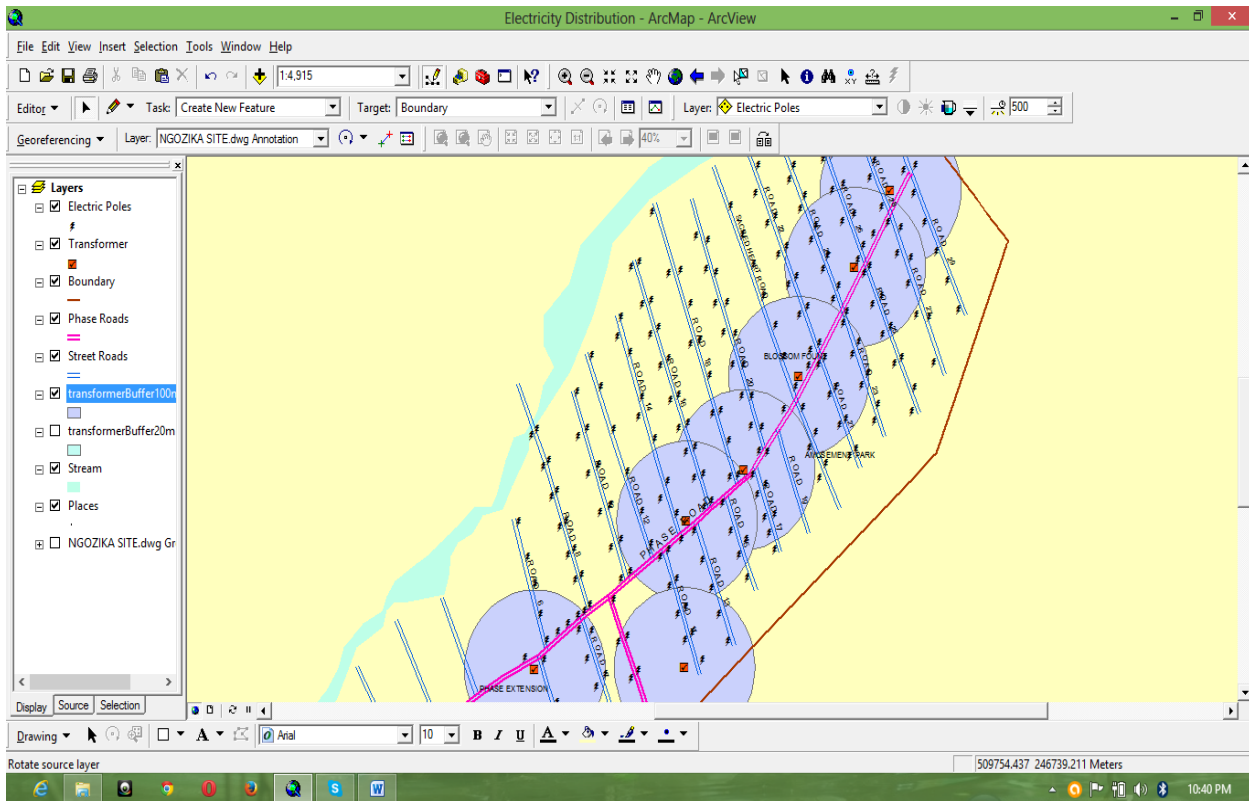


Fig. 4.5: Proximity Analysis Query Of Transformers Within The Study Area.

The proximity analysis was also carried out in 100meters around the transformer. This process can also explain the fact that the electricity distribution in the study area (Ngozika Housing estate Phase 1) is a good one. With 100meters interval transformer can serve the area well unlike areas where you will see one transformer and the next around it is after One kilometer. Management and distribution in such an area is always poor and have a lot of problems. This proximity analysis can also be used in determining area affected when oil spillage occurs in a particular area

V. RESEARCH FINDINGS

Some discoveries in the course of the projects some of the findings are listed below:

- The Estate is a new estate in the sense that it's not up to 10years of creation. As a result is still developing and the population is still ok and conducive for human habitation.
- Most of the festivals especially the important and glamorous ones such as the Imu-awka festival has lost the glamour associated with it. This can be attributed to a lot of factors which might include civilization and peoples deep believe in Christianity in the capital city.
- Another major discovery was the dearth of data such as Population maps, road maps, updated street guides, Electricity distribution map e.t.c. Some of the available ones had coordinate problems.

- Well tarred Streets are almost nonexistent. We say nonexistent because they never went deep enough to create access to the residential buildings in the street. This made people to walk long distances to their home on unpaved roads.
- Also discovered that the number of roads in the Housing Estate is enough at the moment to carry the density of the people living in the Estate. But future increase in the population will also bring about increase in the number of road.

VI. CONCLUSION

GIS as tool in modern day surveying, geospatial mapping and modeling has brought changes to a wide range of applications. Electricity distribution not being an exception has experienced a fair share as evidenced in the production of this geospatial modeling and analysis of electricity distribution in Ngozika housing estate phase 1 Anambra State. The electricity distribution modeling and the analysis will be a veritable tool that will aid potential investors to contribute to the socio-economic development of Awka in particular and Anambra state in general. This study shows that geographic information system (GIS) is a potential tool in modeling and analyzing the distribution of electricity in a given area through the use of computer communication and technology.

VII. RECOMMENDATION

From the processes undertaken and the experiences acquired during the course of the project, the following recommendations are made:

1. The results and analyses so far proved that GIS is one of the best methods to be adopted in geospatial modeling and analysis of electricity distribution. Government agencies, ministries, private commissions, Institutions of higher learning and all other stakeholders in the geospatial modeling operations and electricity distribution especially the ministry of Power, Electricity Distribution Company should as a matter of urgency computerize Electricity distribution operations. We are living in a digital age in which it is difficult to survive without expertise in information and communication technology. This will enable stakeholders in this vital industry to save large volumes of data in an organized manner, such that storage, correction, modelling, update and retrieval of such data can be performed with ease. It will also make it easy to transmit Electricity information to the public at large. Compulsory computer and communication education for the staff employed to manage Electricity distribution mapping, data will enable such staff to understand how to use GIS database developed for Electricity distribution mapping.

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