

## Development of a GIS based tourism infrastructure in Awka, Onitsha and Nnewi urban areas of Anambra state Nigeria

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### Abstract

Tourism is now the greener pastures most developing countries have focused attention to due to its enormous benefits like infrastructural development, job creation, conservation of environment etc. In Nigeria, it is an important sector that has not fully developed, though; it is one of the country's fastest growing industries. Recently, it is contributing about 3% of Nigeria GDP. Tourism is a strong revenue earner; lack of proper management of same has denied Nigeria the benefits accrued from the sector. This research is therefore aimed at the Development of a GIS-Based Tourism Infrastructure in Awka, Onitsha and Nnewi in Anambra State, with the specific objectives of; developing a comprehensive GIS database map showing tourism locations in these cities, to ascertain the pattern of distribution of the tourism infrastructure in Anambra State. This was achieved through the acquisition of base map of the study area and point picking of geometric data of tourism facilities using a handheld Global Positioning System instrument. A functional user friendly spatial database on tourism facilities was developed. ArcGIS 10.7 was used for Geospatial database creation, querying and displaying of results, while Microsoft word 2010 was used for data processing and preparation of reports. The results of database queries showed the locations of tourist locations like, hotel accommodations, relaxation and eating spots, banks and major landmarks all located within Anambra State. In conclusion this research presented the significant role that GIS can play in tourism development in Anambra State, if a complete database for tourism in the state is designed and developed.

**Keywords:** Anambra; GIS; Tourism; Nigeria

### 1. Introduction

Tourism has historically been dependent on the character of the destination, including attractions, beaches and resorts. It is a complex activity that requires the availability of certain parameters (e.g. accessible road networks, standard accommodation facilities, attractions etc.) and information on potential and existing attraction sites. Information on these parameters and attraction sites can be gathered, processed, organized and stored using tools such as Global Positioning System (GPS), Geographic Information System (GIS) coupled with remote sensing. After gathering the needed data about a destination, the data must be stored in a retrievable form to enhance tourism, and this can be achieved with the aid of GIS. Geographic Information Systems (GIS) is one of the most remarkable technologic innovations in tourism planning and decision making. "Both GIS and tourism share a common characteristic, that is, both cross the boundaries of disciplines and application areas. GIS has been applied in many fields including geography, forestry, and urban development and planning, and environmental studies. Similarly, tourism has been a subject of interest to geographers, economists, business, environmental planners, anthropologists, and archaeologists" (Avdimiotis and Christou, 2018:1). This makes the potential applications of GIS in tourism significant. Moreover, maps have been known to play vital roles in identifying and locating tourist attractions. GIS however provides the facility to

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extract different sets of information (e.g. tourist attractions, hotels and their distances from one another, roads, settlements, vegetation, land use data, changes in tourism resources) from a map and use them as required (Fajuyigbe, Balogun and Obembe, 2016) because of the dynamic capability of GIS tools to incorporate changes that occur over time to its database. Tourist maps in Nigeria are not easily seen or available, where available it is lacking in comprehension, accuracy and up-to date geo-referencing (Olabintan and Ajiroto, 2012).

The World Tourism Organization defines tourists as 'people traveling to and staying in places outside their usual environment for not more than one consecutive year for leisure, business and other purposes'. It is the temporary movement of people to destinations outside their normal places of work and residence, the activities undertaken during their stay in those destinations and facilities created to cater to their needs (Cook et al, 2006).

There are various kinds/forms of tourism namely: cultural tourism, religious tourism, business tourism, sports tourism, ecotourism, humane tourism, responsible tourism etc. Tourism has historically been dependent on the character of the destination, including attractions, beaches and resorts. It is a complex activity that requires the availability of certain parameters (e.g. accessible road networks, standard accommodation facilities, attractions etc) and information on potential and existing attraction sites. Information on these parameters and attraction sites can be gathered, processed, organized and stored using tools such as Global Positioning System (GPS), Geographic Information System (GIS) coupled with remote sensing. After gathering the needed data about a destination, the data must be stored in a retrievable form to enhance tourism, and this can be achieved with the aid of GIS.

GIS is a computer based set of tools for collecting, mapping, analysing, storing, retrieving, and displaying spatial and non-spatial data from geographic world for a particular set of purposes that varies from one discipline to another. It is computer software that links geographic information (where things are) with descriptive information (what things are). Unlike a flat paper map, where what you see is what you get, GIS can present many layer of different information (www.esri.com). GIS is both a database system with specific capabilities for spatially referenced data as well as a set of operations for working (analysis) with the data (Wheatley et al. 2002). It is also a set of computerized tools used to collect, archive, manage, retrieve, analyse and output geographic and other related kinds of attribute data (Chikwanda 2004). According to Fellaman et al (2008) GIS is "both an integrated software package for handling, processing, and analysing geographical data and a computer database in which any piece of information is attributed to a precise geographic location. They further explained that a GIS database can be seen as a set of discrete informational overlays lined by reference to a basic locational grid of latitude and longitude.

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## 2. Literature Review

Many researchers in the recent past have discovered and proposed different views of G.I.S on tourism. The applications of G.I.S in tourism have been classified into the themes. The chosen themes are: Tourism resource inventory, Development preferences, Land use planning, Site selection, Analysis of tourist behaviour, Resource evaluation, Impact assessment, Tourism information system, Tourism recommendation system, Path finding, Virtual tour and traffic plan. Some of them are discussed below:

Ashiekh (2013) utilized GIS in exploring and analysing the tourism attraction in Alsoda region. The author firstly introduced the concept of GIS as one of the most advanced modern technological applications in the field of tourism; secondly, utilized GIS in exploring and analyzing the tourism attraction factors in Alsoda region; and thirdly concluded the optimum use of the area to increase tourists' traffic and suggested the best tourism planning for the area. The study relied on descriptive analytical methods for the tourism attractions factors analysis in the Soda Mountain, using GIS technology. The study was carried out in three divisions. The first section focuses on the characteristics and patterns of tourism in Alsoda Mountain and has a general review of the concept and patterns of tourism in the region. The second focuses on the implementation of geographical information systems in tourism industry. The third section covers the fieldwork visit and using the satellite images, topographical maps, tabular database as data source for GIS use. Arc GIS was used to create spatial database, connect geographical databases, inquire about spatial and non-spatial phenomenon and determine the tourism patterns distribution over the landscape.

Tourism infrastructure, is the physical element that is created or made to cater for tourists, including the visible elements of landscape (Tress and Tress, 2003; Hamzah, 2009; Ayeni, 2011) this implies as further argued by Ayeni (2011) that every physical element seen in and around tourist environment which enhances tourism development can be referred to as tourism infrastructure.

GIS has also been very useful in facilitating land use/cover change studies. These capabilities make it a promising tool, especially for land use planning and land use/cover change modelling. Bunruamkaew and Murayama (2012) evaluated the land use and natural resources for future sustainable ecotourism site planning using GIS as a tool. The land cover data and ecotourism suitability data was integrated with other GIS datasets to evaluate the land use and natural resources at a district level in SuratThani Province. Finally the area that is best suited for assessing ecotourism suitability was identified using Analytic Hierarchy Process (AHP). This type of work can be useful for tourism facilities development.

Fajuyigbe et al (2007) developed a web-based Geographical Information System (GIS) for Tourism in Oyo State, Nigeria and their project revealed that presenting tourism information in GIS in a computer environment and the internet would offer an unparalleled platform for the management and promotion of the tourism industry in Oyo State. Though, the integration of tourism data and GIS data is still a big challenge for the tourism industry today, it was observed from the reviewed literatures that using GIS always keeps the information up to date, reduces cost and saves time, provides information for decision support and policy making, increases efficiency in tourism activities, increases management control etc (Avdimiotis and Christous, 2002; Seker et al 2002; Ayeni, 2006; Fajuyigbe et al 2007; Fadahunsi, 2010). The advantages of GIS in tourism as identified above, informed the choice of this research which sought to design and develop a GIS database for tourism using spatial and attribute data in Anambra State as this has not been done for the State.

## 2.1. Study Area

Anambra derived its name from Omambala River which is easily called Anambra River. Omambala River is on the Northern part of Anambra State and stretches to the famous River Niger (Odum 2011). The indigenous ethnic groups in Anambra state are the Igbo (98% of population) and a small population of Igala (2% of the population) who live in the North western part of the state ([http://en.wikipedia.org/wiki/Anambra\\_State](http://en.wikipedia.org/wiki/Anambra_State)). Anambra State is geographically located in the south-eastern Nigeria, and it is bounded by Delta State to the West, Imo State to the South, Enugu State to the East and Kogi to the North. It is located between Latitude 5° 41.293'N and Latitude 6° 46.327'N, and Longitude 6° 37.014'E and Longitude 7° 21.608'E (Fig. 1a and 1b). It has one of the highest population's densities in Africa. The State comprises numerous thickly populated villages, a number of small towns and a few major towns; some areas are so thickly populated that the estimated density is 1500-2000 persons living within every square kilometer. ([www.anambrastate.org](http://www.anambrastate.org), accessed on: March 13, 2022).

Anambra State is home to the longest river in Nigeria which is the River Niger. About 35 percent of the State's total land mass consists of water. The State also boasts of a tropical savanna climate with average annual rainfall estimated at 2,700 millimeters. The average temperature of Anambra State is 25 degrees centigrade with topography prone to gully erosions but comprising of arable farmlands for agricultural activities.

In 2006, the population was estimated to 4,182,032, while the density remains 863/km in 2006 (Odum 2011) with a total land area of 4,844 km<sup>2</sup> (1,870 sq. mi) ([www.anambrastate.org](http://www.anambrastate.org) accessed on: March 13, 2022).

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## 3. Material and methods

### 3.1. Data Requirement and Sources

The data required for achieving the aim and objectives of this study includes the following:

- Digital Globe Imagery covering Anambra State. This was sourced from [www.digitalglobe.com](http://www.digitalglobe.com)
- Tourism facilities Directory for Anambra State, this was sourced from the Ministry of Arts and Culture.
- Location of Tourism centers in Anambra State. Handheld GPS was used to collect the coordinates of the tourism centers.
- Demographic data was sourced from the National Population Commission, Anambra state office.
- Other relevant data (attribute data) were sourced from statutory bodies where necessary.

### **3.2. Data Acquisition**

Two methods of data acquisition were used which are: Primary method and secondary method.

#### *3.2.1. Primary Data*

The primary dataset used in this work was obtained through site visit. The positions of some tourism facilities in Awka, Onitsha and Nnewi in the state were collected using GPS.

#### *3.2.2. Secondary Data*

The secondary datasets were gotten from digitization of available map data and attribute data.

### **3.3. GIS Database Creation and Modelling**

- The methodology employed in this study involves conversion of analogue map into digital map, plotting of coordinate points, multipurpose Geo-database creation and queries generations. First, the analogue map of Anambra State was converted to a digital map through the process of scanning, dereferencing and digitizing. The coordinates of tourism facilities gotten during field work were plotted on the map, after which a robust multipurpose geospatial database was created with the attribute and demographic data. Consequently, the database was analysed and various queries generated for the study, such queries includes locational query, accessibility query.
- In achieving the objectives of the study, pattern and distribution of tourism facilities were investigated; this was done by applying nearest neighbour analysis.
- A multipurpose geospatial database of the tourism facilities in Anambra State was created. To achieve this, the database creation stages were categorized into conceptual modelling, logical data modelling, and physical database design.

#### *3.3.1. Conceptual Modelling*

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 will be presented in a simplified manner and to the satisfaction of the information requirement of the project were made. The stages in the conceptual data modeling involved the four steps: identification of entities, identification of attributes, determining relationships, drawing of entity-relationship diagram.

#### *3.3.2. Logical Data Modelling*

This is a representation of the conceptualization of the reality in a data structure that can be implemented by the computer software to be used. In this project, the relational data model was used. In a relational data model, data are separated into tables, and each table contains items of data called fields. Fields are objects (attributes of entities). The entities and attributes are translated into a geo-relational data structure and the following relations were derived.

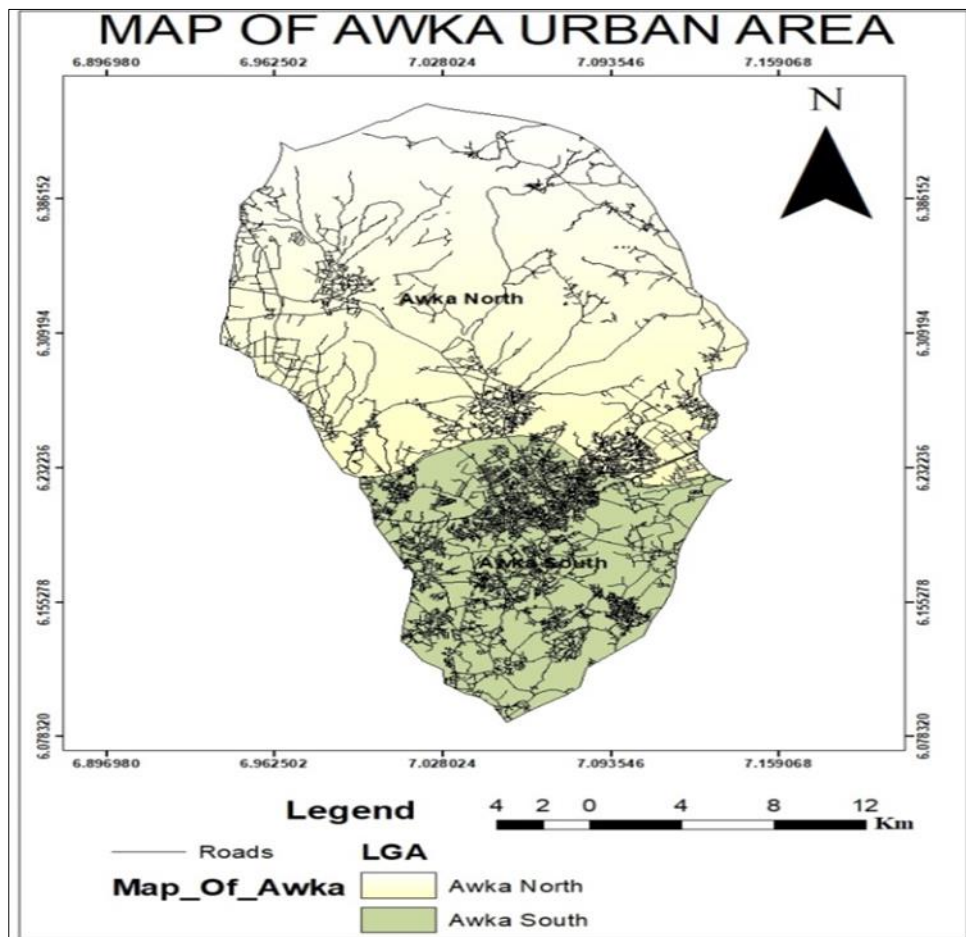
#### *3.3.3. Physical Database Design*

The representation of the data structure in the format of the implementation software is usually done at the beginning of the database creation phase. This involves the translation of the real world entities into the computer compatible forms of the chosen structuring methods i.e. network, hierarchical and relational. In this study, the relational (table) structuring method will be used. In this method, tables consisting of columns (fields) and rows (records) will be created to show the relationship between different data. The tables were structured in such a way that they can be linked with one another for connectivity.



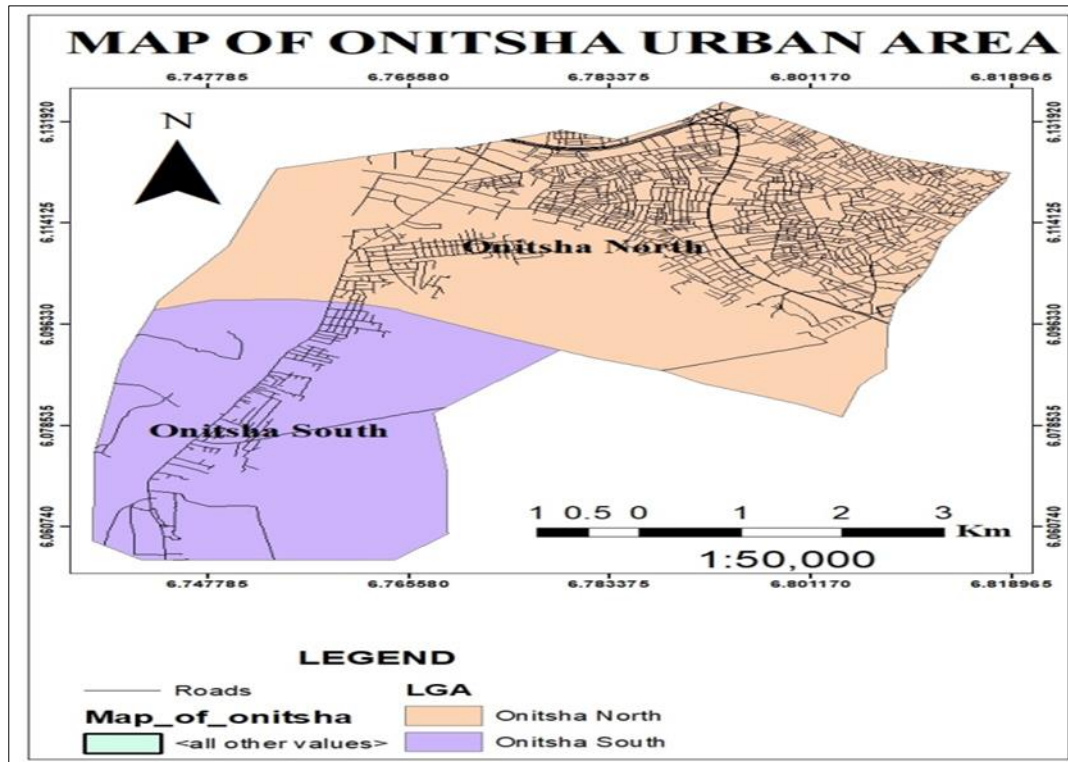
Source: (Department of Surveying and Geoinformatics, UNIZIK)

**Figure 1a** Map of Nigeria Showing Anambra State



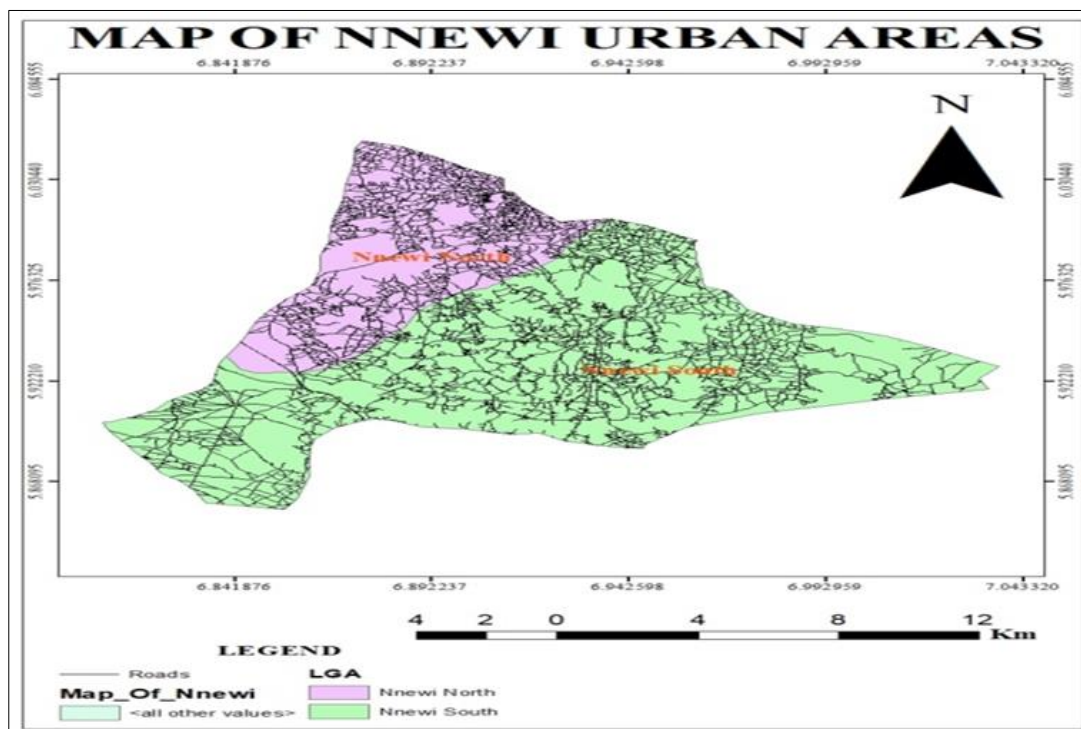
Source: (Department of Surveying and Geoinformatics, UNIZIK)

**Figure 1b** Map of Awka Urban Area



Source: (Department of Surveying and Geoinformatics, UNIZIK)

Figure 1c Map of Onitsha Urban Area



Source: (Department of Surveying and Geoinformatics, UNIZIK)

Figure 1d Map of Nnewi Urban Area

#### 4. Challenges of GIS In Tourism

Tourism is an activity highly dependent on environmental resources. It is also a phenomenon, which in the event of lack of planning and management is likely to erode its environmental base (Ayeni, 2012).

Some of the core problem(s) often encountered in the tourism industry of which this study will be addressing includes:

- Lack of data and a quick update and maintenance of available data in major cities of Anambra State.
- Ineffective management of these spatial information also provide a means by which local governments loose enormous revenue which would have been used to provide the necessary infrastructure which improve the values and living standard of the people in the light of the statutory allocation.
- Lack of proper management of tourism potentials has made it difficult for Nigeria to be a major tourist attraction in Africa. Employment opportunities and revenues which could have been generated from tourism are not being harnessed and where they are harnessed, they are wrongly estimated.

#### *Recommendations*

An up-to-date tourist map is the most important ingredient for a sustainable tourism planning. The available maps are static in form and limited in its application and no new information can be extracted from the printed maps. Any additional alteration regarding present proposed land-use or road network is very difficult to represent on a plan. This leads to proliferation of illegal recreational centers, hotels and other tourists' facilities. Locations of most tourist facilities are also not known within the localities where they exist. When a traveller picks up a Hertz NeverLostsm equipped rental car, he or she can punch in the address of a hotel and receive computer-generated voice instructions and video display of the directions (Cook et al, 2006).

The need to properly investigate the use of GIS in the Development of Tourism Infrastructure in these urban areas of the state is of a great importance. Institutions of higher learning are to take the lead in the integration of GIS into various courses with special interest in archaeology (including geography) and tourism studies with the aim of making tourism in Nigeria meet up with international standards (Olukole, 2007). It will also equip Nigerian graduates to compete favorably with their peers all over the world, and we equally advocate for establishment of GIS centers in all the thirty-six States of the federation.

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#### 5. Conclusion

This study has successfully demonstrated the use of GIS in location of tourism facilities in Awka, Onitsha and Nnewi urban areas of Anambra State area using GIS approach. The capabilities of Information System in GIS to conduct spatial search and provide answers to some generic question has been established. The database created was carefully accessed and tested with various queries invoked. The information generated can assist in decision making in sitting tourist facilities by various authorities involved.

GIS use has so far provided successful results which promote importance of information over technology. The reality is that geographic data in actual world come in many different formats. In this paper GIS has been established as a tool for collecting, analyzing, modelling and visual presentation of tourist data. Geographical information system is a rapidly expanding field enabling the development of applications that manage and use geographic information in combination with other media. In the tourism industry, government strategy, decision making, GIS is used to provide: digital basic map, digital files for analyzing and mapping, digital files for mobile mapping and modelling, digital multimedia.

In this study, the analyses of hotels and other tourism facilities in Awka, Onitsha and Nnewi urban areas of Anambra State with respect to other spatial data had been achieved. The use of GIS has help to manipulate and show the relationship between the attribute and spatial data through single and multiple queries. This study has shown that it is possible to store, manipulate, and analyze data relating to tourism facilities distribution at no extra cost implication in an easy to understand format for the end-user. This database created is effective and it satisfies all of the stated objectives. The database created has been thoroughly accessed, managed, displayed and tested through various queries. The database can also serve as a Decision Support System (DSS).



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## Compliance with ethical standards

### *Disclosure of conflict of interest*

No conflict of interest to be disclosed.

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