



Investigation of Trespassing and Irregularities in Physical Planning Using Remote Sensing and Geographical Information System

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Abstract Urban planning need to be regulated by laws , and in the Sudan there are adequate laws , but the problem is an inspection of the building construction at stated in the law which based on direct field work ,that need many financial and human resources . As the matter of lack of these resources the problem of the urban planning increases the spread of urban planning problems, such as trespassing on public area and roads. Digital technique of remote sensing and geographical information systems provide efficiency, high reliability, low cost and offered possibilities to control urban grows with sustainable manner (make good decision). This study focused in modern techniques to execute the laws and regulations of urban planning to detect irregularities of building within and outside of the widget and the residential area using GIS, AutoCAD, Erdas Software and Nyala digital map and 24 control points data sources with appropriate distribution through the map, this techniques had been applied in this study to detect the buildings constructed out of plots bounders and empty open spaces, and trespassing or irregularities can be monitored and detected. Finally this trespassing an irregularities most are in open spaces.

Keywords Nyala, Planning, Urban Growth, Digital Map

Introduction

Sudan has been started urban planning since the beginning of the twentieth century in conception of western style, the first law of urban planning established the middle of last century. Planning committee was founded for planning the central cities under the supervisor of the Ministry local Government and Urban planning, but it seems that the planning of Nyala state lacks in observation. In spite of all the previous and current construction laws, state of Nyala could not remove the irregularities.

In the last ten years Nyala city has witnessed increase in the population. Because of the ongoing war in Darfur this increase has led to increase in the city dwellings. No need to say that the urbanization has not been studied by correct scientific methods which led to an imbalance between land use and efficiency. Also there were planned housing schemes before more than twenty years were not executed because of the lack of adequate studies of such schemes. There is also considerable desperate need to make a digital map of Nyala to be linked with data base of land uses, in order to take advantage of them for the purpose of planning and access to sound decision by decision makers.

In this project Nyala had been chosen and taken as a sample for some irregularities in the building and the lack of commitment to urban planning laws, the current system in able to control and remove these irregularities.

Objectives of the Study

The main objectives of this study can be categorized in the following

- Design digital system with high efficiency and accuracy and low cost to enable the application of the laws of urban planning and trespassing.



- The possibility of detection of irregularities of buildings within and outside of the widget residential areas using GIS, satellite imagery and aerial photography and control points.
- The allocation of houses to accommodate the displace people and refugees.
- control and knowledge irregularities in the office without visiting

Study Area (Nyala city)

• Introduction

Nyala is the capital of south Darfur State in west Sudan and the railway of the west of Sudan is end in it, and it is the center of maintenance of trucks and lorries of a large area of west Sudan and even from neighboring countries and its commercial area, it has a biggest market of livestock and crops in western Sudan most of public services is concentrated in Nyala.

Nyala consists of tow localities, Nyala municipality and Nyala north locality, the city is crossroads of roads from eastern Darfur to the western and from north to south. The economics of the city is depends to the agriculture which is the mainstay of its economy, include products millet, maize, groundnuts and gum Arabic. And also the economic depends to livestock trade which export to different markets inside and outside Sudan. Also there was slaughterhouse, world-class shares in the export of meat to the neighboring countries especially Egypt and Saudi Arabia Kingdom, this helped by the presence of an International Airport. There is also areas of tourist and recreational in Nyala , in the city there is about 18 branches of banks include branch of central bank of Sudan , these banks offer various banking services like deposition , withdrawal, financing and transfers .

Also there is Stock Exchange of agricultural crops which was established in 1963, and it becomes the third international Stock Exchange for the agricultural products in Sudan after AlQadarif and Al Ubayyid Stock Exchange.

• Geographical location of Nyala City

The geographical location includes two types, astronomical location and relative location, the astronomical location specified by longitude and latitude, and answering question about where is it. The relative location specify the location of features relatively to another features, hence appeared the importance of relativity, so some sites enjoyed by the accessibility, while the ether sites distinguished by low degree in the accessibility, and remained isolated.

a. Astronomical location

Nyala city is located within Latitude $11^{\circ} 59' N$ and $12^{\circ} 07' N$ and Longitude $24^{\circ} 49' E$ and $25^{\circ} 00' E$.

b. Relative location

Nyala city located in west Sudan in the north east part of southern Darfur with average altitude 650m above the Mean Sea Level, south the mountain of Jebel Mera and its far from Khartoum by 900km, and the Birli valley divides the city from the west to the east making two parts. Figure (1) represents the location of Nyala city.



Figure 1: Location of Nyala City

c. Population Distribution

Nyala city is the most populous city in Sudan with an estimated 538,518 people living in the city, according to Sudan population census in 2008, this population distributed in two localities, Nyala municipality with 305,060 people and Nyala north locality with 233,458 people, all this population distributed in 41 neighborhoods, the



table below shown the distribution of population in Nyala neighborhoods. Table (1) represents distribution of population and figure (2) represents Nyala city map.

Table 1: The population Distribution

(Source: Central Bureau of Statistics South the Fifth Census Population 2008)

| No | Neighborhood Name | Population |
|----|-----------------------|------------|
| 1 | Alriad | 17342 |
| 2 | Almsani | 14677 |
| 3 | Alemam | 07268 |
| 4 | Alshorta | 11093 |
| 5 | Alsalam | 20251 |
| 6 | Alentifada | 08296 |
| 7 | Altadamon | 05949 |
| 8 | Alnasr | 05042 |
| 9 | Althora | 09245 |
| 10 | Khartoum Belail North | 05619 |
| 11 | Khartoum Belail South | 09181 |
| 12 | Almtar | 04375 |
| 13 | AlsedAlaali | 06488 |
| 14 | RayigAlkango | 04122 |
| 15 | Alnahda | 09352 |
| 16 | Draij | 04814 |
| 17 | AlsikaHadid | 08568 |
| 18 | tyba | 08759 |
| 19 | Alnil | 19944 |
| 20 | Alemtidad | 02779 |
| 21 | Aljmhoria | 14831 |
| 22 | Aljeer (A) | 10871 |
| 23 | Aljeer (B) | 10729 |
| 24 | Aljeer (C) | 12971 |
| 25 | Aljeer (D) | 04789 |
| 26 | Alwadi East | 09098 |
| 27 | Alwadi West | 07362 |
| 28 | Karari | 11213 |
| 29 | Karari West | 18328 |
| 30 | Karari Alemtidadat | 16226 |
| 31 | Alwhda (A) | 13934 |
| 32 | Alwhda (A) | 15177 |
| 33 | Alwhda (A) | 23626 |
| 34 | Alwhda (A) | 21550 |
| 35 | KharbAlezaa | 16123 |
| 36 | Mjook | 04396 |
| 37 | Aljebel (A) | 11530 |
| 38 | Aljebel (B) | 10762 |
| 39 | Aljebel (C) | 04876 |
| 40 | Draij Camp | 19799 |
| 41 | Otash Camp | 51629 |





Figure 2: Nyala city map

Table 2: The Evaluation of an Urban Area of Nyala

| Class | Class size and permitted building | Period of lease | Service provision |
|---------|--|-----------------|---|
| Class 1 | 500- 600m.m Multi-storey building permitted | 50 years | High quality –roads, water, electricity etc |
| Class 2 | 300- 400m.m2storey building permitted | 40 years | Moderate quality |
| Class 3 | 300m.m1-storey building permitted | 30 years | Lower quality of service |

d. An urban area in Nyala is divided in to three types

1. Residential areas

Urban residential area in Nyala has been categorized in three classes. A legacy from the colonial period table no (2) describes these classes.

The most building was built of bricks and the roofs from zinc. There is also few styles of buildings from local material (reeds-mud), The new first class buildings is high rise, the prize of the land increase in the center of the city (downtown), near the markets, near the asphalt roads and in the first class

2. Market Area

In Nyala there is 10 markets distributed in whole the city. The essential market is in the center of the city.

3. Industrial areas

Industrial area in Nyala was located in the north east part of the city. The industries in Nyala are for light industries products, for example plastic products and oil industries.

Materials and Methods

Methodology used in this study can be Divides in to the following steps:

- Data Collection
- Combination Maps and Create Layers
- Transformation map from AutoCAD to GIS
- Download Image and Mosaic in Erdas
- Georeferencing the Image with control points in GIS
- Review Image with control points
- Matching Image with full map (complete)
- Matching Image with map layers (one by one)
- Detecting Samples of Trespassing
- Detecting Samples of Irregularities
- Detecting Samples of Over lapping
- Creating trespassing and irregularities Layer and table of distend and bearing and coordinate between center point and trespassing. Figure (3) represents the flow chart of the study



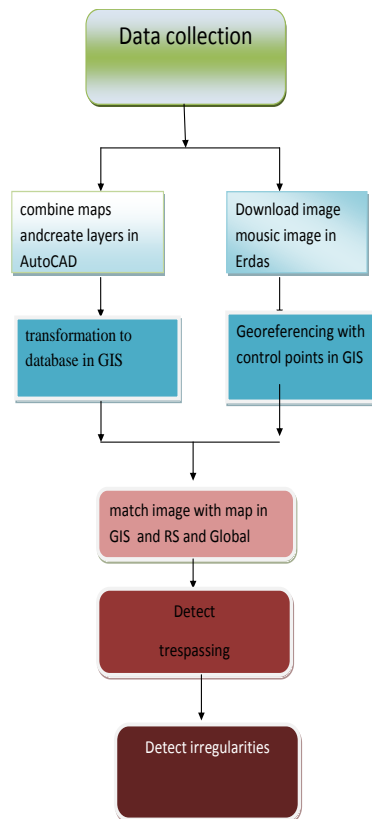


Figure 3: The Flow Chart of the study

Result and Analysis

Introduction

Analysis of measurement was done using Arc GIS 10 (measurement steps) in accordance with law to organize the construction of Nyala and satellite image and control point had been used as reference to verification of irregularities in out of plot boundaries.

Results of the Study

1. Verification the Trespassing in open spaces.

During map and Image. the trespassing and irregularities has been detected taking a sample in Block (15H), (13H), (19A), (17B), (22A), (1H), (14H), (17H), (3Y), (4Y), (2Y), (8Y), (PY), this trespassing 80% are in open spaces as residential uses with a small areas .

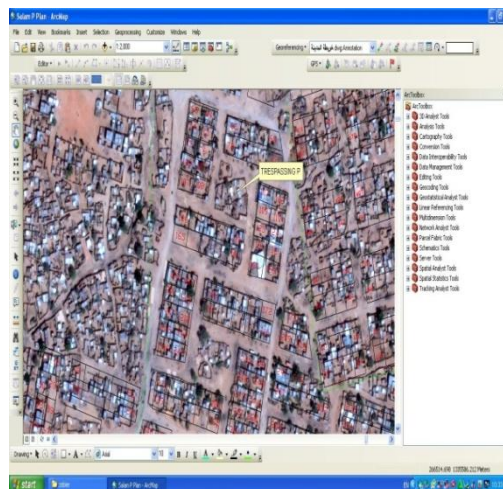


Figure 4: Trespassing Areas Open Space

2. Verification the trespassing in the Houses Building.

currently this kind of trespassing in street and main roads as a shops and restaurant, all marching places, it sample in Block (jabal marra Street 10A) , (SENIMA street ELgamhoriya), (4H), (5H), (2L).

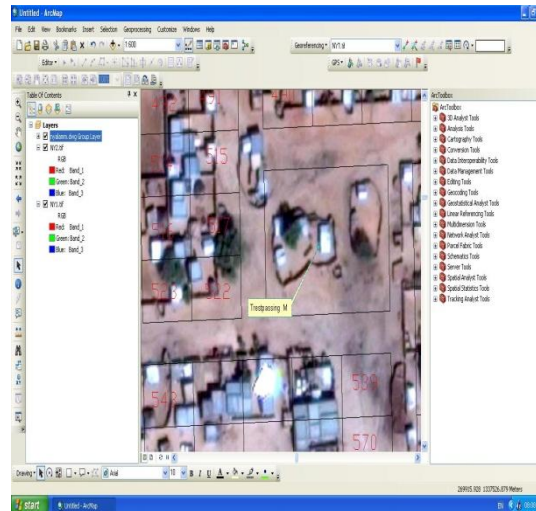


Figure 5: Trespassing in houses building

3. Verification the irregularities in the Government reserve and services Area

These kinds are found in unbuilt area like Hospital, Market, public yard, then take sample in Block (17D), (4Y), (4LG).

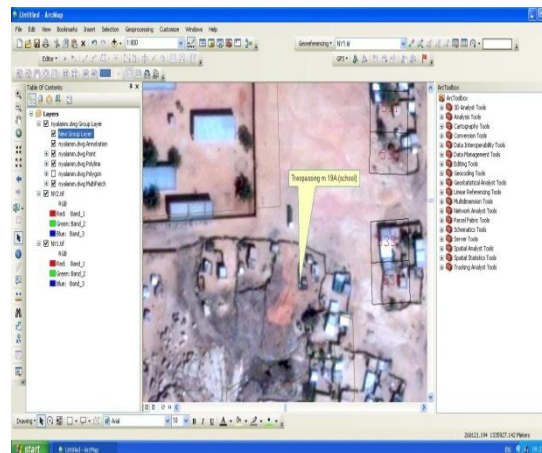


Figure 6: Irregularities Areas in Schools and Government

4. Verification the trespassing in houses boundaries with other houses and roads

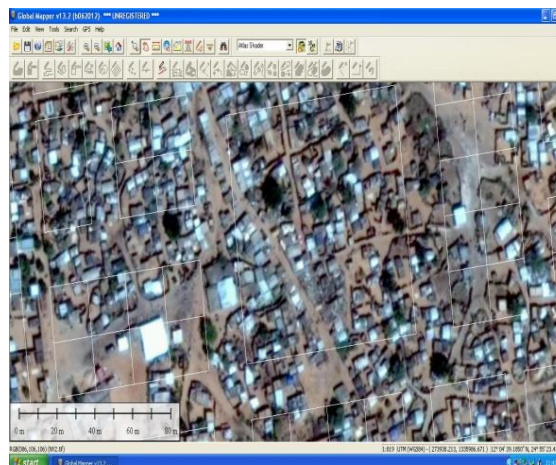


Figure 7: Trespassing in houses boundaries

Analysis of Results

• Verification a distance, bearing and coordinate

- Distances and bearings of trespassing areas were calculated using network analysis in Arc GIS in addition to coordinates, considering the center point is the survey office.

1. Creating table of distances, bearing and coordinates

To create table of distend and bearing and coordinate between the center point (survey office) and trespassing, irregularities areas used the GIS, in Arc tool box, analysis tool, proximity, Generate near table. During this tools the table were created

Table 3: Distances, bearing and coordinates

| OBJECTID ^a | IN_FID | NEAR_FID | NEAR_DIST | NEAR_RANK | FROM_X | FROM_Y | NEAR_X | NEAR_Y |
|-----------------------|--------|----------|-------------|-----------|---------------|---------------|---------------|----------------|
| 1 | 0 | 1 | 640.571153 | 1 | 269032.204888 | 1333490.21454 | 268394.310853 | 1333548.717649 |
| 2 | 0 | 2 | 640.571153 | 1 | 269032.204888 | 1333490.21454 | 268394.310853 | 1333548.717649 |
| 3 | 0 | 6 | 763.804895 | 2 | 269032.204888 | 1333490.21454 | 268959.137888 | 1334250.51664 |
| 4 | 0 | 11 | 763.804895 | 2 | 269032.204888 | 1333490.21454 | 268959.137888 | 1334250.51664 |
| 5 | 0 | 3 | 1169.302417 | 3 | 269032.204888 | 1333490.21454 | 269095.638237 | 1332789.734161 |
| 6 | 0 | 5 | 1447.73691 | 4 | 269032.204888 | 1333490.21454 | 270476.5095 | 1333599.845696 |
| 7 | 0 | 26 | 1624.682709 | 5 | 269032.204888 | 1333490.21454 | 270639.21 | 1333251.199 |
| 8 | 0 | 24 | 1811.832098 | 6 | 269032.204888 | 1333490.21454 | 267396.267 | 1334389.959 |
| 9 | 0 | 28 | 1914.247276 | 7 | 269032.204888 | 1333490.21454 | 268834.755 | 1335228.103 |
| 10 | 0 | 21 | 2602.69945 | 8 | 269032.204888 | 1333490.21454 | 266620.443 | 1332511.748 |
| 11 | 0 | 20 | 2723.690133 | 9 | 269032.204888 | 1333490.21454 | 267524.726 | 1331221.736 |
| 12 | 0 | 12 | 2957.676751 | 10 | 269032.204888 | 1333490.21454 | 270883.701 | 1331183.486 |
| 13 | 0 | 13 | 2957.676751 | 10 | 269032.204888 | 1333490.21454 | 270883.701 | 1331183.486 |
| 14 | 0 | 16 | 2957.676751 | 10 | 269032.204888 | 1333490.21454 | 270883.701 | 1331183.486 |
| 14 | 0 | 16 | 2957.676751 | 10 | 269032.204888 | 1333490.21454 | 270883.701 | 1331183.486 |
| 14 | 0 | 16 | 2957.676751 | 10 | 269032.204888 | 1333490.21454 | 270883.701 | 1331183.486 |

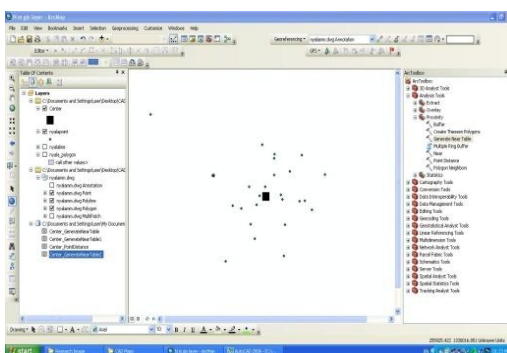


Figure 8: center point and trespassing and irregularities areas

2. Creating table of distend using network analysis

To create table of distances between the center point (survey office) and trespassing, irregularities areas using network analysis tool in ArcGIS, to determinate the total distance.

Conclusion

The professional software used in this study are Erdas Imagine Software, Geographical information System (GIS), Global mapper (GM) and AutoCAD Techniques, then Matching with accurate sources of Control points of Nyala from (GPS RTK) and Digital image of Nyala and Digital Map of Nyala from Ministry of planning South Darfur then the following were detected:

a. Houses boundaries and buildings irregularities.

b. Open spaces and public areas trespassing.

c. Percentage of trespassing and irregularities.

The main conclusions obtained from the results and analysis of this research can be expressed as follows;

- These techniques depending on Image resolution, and accurate maps.
- Determination of distances, bearings and coordinates of point between the center point (survey office) and trespassing, irregularities areas using GIS tools (network analysis).



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