

Sudan University of Science and Technology

College of Graduate Studies



A Thesis Submitted as a Partial Fulfillment to the admission of The
Degree of Master in Surveying

**Investigation Of Trespassing And Irregularities In Physical
Planning Using Remote Sensing and Geographic Information
System
(Case Study: Nyala City)**

كشف التعدي والمخالفات في التخطيط الحضري باستخدام نظم المعلومات الجغرافية
والاستشعار عن بعد
(دراسة حالة: مدينة نيالا)

Prepared by:

Elzobier Abdallah Sieed Abdallah

Supervised by:

Dr. Mohammed Alameen Ahmed

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

الآية

قال تعالى:

تَقَدْ أَرْسَلْنَا رُسُلَنَا بِالْبَيِّنَاتِ وَأَنْزَلْنَا مَعَهُمُ الْكِتَابَ وَالْمِيزَانَ لِيَقُومَ
النَّاسُ بِالْقِسْطِ وَأَنْزَلْنَا الْحَدِيدَ فِيهِ بَأْسٌ شَدِيدٌ وَمَنَافِعُ لِلنَّاسِ وَلِيَعْلَمَ
رَبُّهُ مَنْ يَنْصُرُهُ وَرُسُلَهُ بِالْغَيْبِ إِنَّ اللَّهَ قَوِيٌّ عَزِيزٌ

صَبَّحَهُ اللَّهُ الْعَظِيمَ

Abstract

Urban planning need to be regulated by laws , and in the sudan there are adequate laws, but the problem lies in inspection of the building construction as 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 increase the spread of urban planning problems , such as trespassing on public area and roads .

Digital technique of remote sensing and geographical information system and global mapper and autocad provide speed and efficiency , high reliability and low cost had offered possibilities to control urban growth with sustainable manner(making good decision) .

In this study modern system had been proposed to a chaive high efficiency and low cost to execute the laws and regulated of urban planning to detect irregularities of building withen and outside of the widget and the residential area using GIS, AuTOCAD , RS ,GM Softwares and high accurate satellite imagery (15to20cm) 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 .

ملخص البحث

التخطيط الحضري يحتاج الي قوانين تنظمه , في السودان قوانين كافية لذاك الغرض , لكن المشكلة يكمن في طريقة تفنيش ومراقبة وتابعة مخالفات المباني التي تعتمد علي عمل ميداني المباشرالذي يحتاج الي تمويل وموارد بشرية .

عدم توفير هذة الموارد يزيد في نسبة انتشار المخالفات والتعدي في القطع السكنية والشوارع . التقنيات الرقمية المتمثلة في برامج نظم المعلومات الجغرافية والاستشعار عن بعد والايوتوكاد والقلوبال مابر والتميزة بخصائص السرعة , الدقة , الوثوقية , الكفاءة , قلة التكلفة تساعد في ضبط التعدي والمخالفات ودعم كبيرلاتخاذ القرار السليم .

في هذه الدراسة تم اقتراح الانظمة الحديثة للحصول علي دقة عالية بتكاليف اقل لتنفيذ القوانين وتنظيم التخطيط الحضري لتحديد مخالفات المباني داخل وخارج المناطق السكنية باستخدام نظم المعلومات الجغرافية والاستشعار عن بعد والايوتوكاد والقلوبال مابر وتطبيقها مع برامج الخريطة الرقمية والصورة الرقمية ونقاط الضبط لمدينة نيالا موضع الدراسة لضبط ومراقبة وملاحظة المخالفات والتعدي في القطع السكنية ومواقع خدمات .

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CHAPTER ONE

Introduction

1.1 Overview

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 previous century . planning committee was founded for planning the central cities under the supervision of the Ministry local Government and Urban planning ,but it seems that the planning of Nyala city 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 is able to control and remove these irregularities..

1.1 Research problems

1- the current system which depended on direct field work expensive , inefficient slow , unreliable to control physical planning and irregularities.

2- the existing management system does not benefit the available digital map , satellite imagery and aerial photography to gather with the require instrument s and software .

3- Rebel attack rural places then refugees and displaced people come to urban .

1.2 Research Objectives

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

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

2 – 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 .

3- The allocation of houses to accommodate the displace people and refugees .

4- control and knowledge irregularities in the office without visiting . .

1.5 Research Layout

This Research organized into Six chapters , the first chapter is an introduction and introduce s the topic and explain the problem of the research in addition to discusses the history and resent urban planning in sudan .

chapter two describes the software used in this research are Geographical information system (GIS), Remote Sensing (RS), Global Mapper (GM) and AutoCAD Drawing .

Chapter three is taking the characteristic of study area (Nyala city) as the location and population distribution and evaluation of city .

Chapter four is about the data sources and methods to give the source of all data ,and methodology used .

Chapter five is about analysis and result to show are the data analysis and result .

A last Chapter is about conclusion and recommendation .

CHAPTER TWO

Remote sensing and Geographical information system and Global mapper

2.1 Remote Sensing

Remote sensing is the acquisition of information about an object, without being in physical contact with that object

Remote sensing is the ability to measure the properties of an object without touching it.

Remote sensing can be defined as the collection of data about an object from a distance .Humans and many other types of animals accomplish this task with aid of eyes or by the sense of smell or hearing.

Remote sensing is the science (and to some extent ,art) of acquiring information about the Earth's surface without actually being in contact wiit.

(Zomrawi , Nagi (may 2011),

2.1.1 Element of the remote sensing

1.Energy Source or Illumination(A) the first requirement for remote sensing is to have an energy source which illuminates or provides electromagnetic energy to the target of interest.

2.Radiation and the Atmosphere(B) as the energy travels from its source to the target ,it will come in contact with and interact with the atmosphere it passes through .This interaction may take place a second time as the energy travels from the target to the sensor.

3.InteractionwiththeTarget(C) once the energy makes its way to the target through the atmosphere ,it interacts with the target depending on the properties of both the target and the radiation.

4. Recording of Energy by the Sensor (D) after the energy has been scattered by , or emitted from the target ,we require a sensor (remote-not in contact with the target) to collect and record the electromagnetic radiation .

5. Transmission, Reception, and Processing (E) the energy recorded by the sensor has to be transmitted , often in electronic form ,to a receiving and processing station where the data are processed in to an image (hard copy and /or digital .

6. Interpretation and Analysis (F) the processed image is interpreted ,visually and /or digitally or electronically ,to extract information about the target which was illuminated.

7. Application (G) the final element of the remote sensing process is achieved when we apply the information we have been able to extract from the imagery about the target I order to better understand it ,reveal some new information ,or assist in solving a particular problem .

(Zomrawi , Nagi (may 2011),

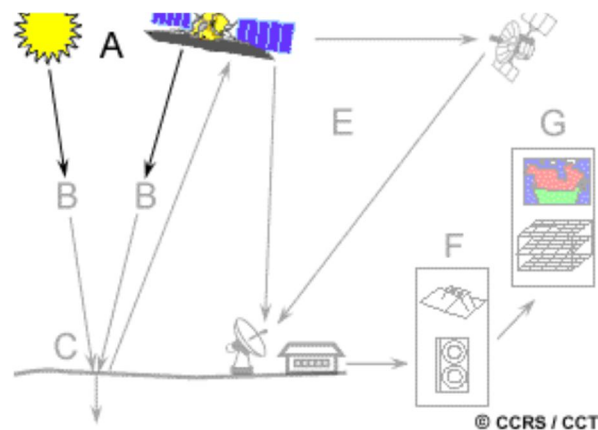


Figure (2.1) Element of remote sensing

2.1.2 Passive And Active Remote Sensing

There are two types of Remote Sensing

2.1.2.1 Passive sensors

can only be used to detect energy when the naturally occurring energy is available. For all reflected energy, this can only take place during the time when the sun is illuminating the Earth. There is no reflected energy available from the sun at night. Energy that is naturally emitted (such as thermal infrared) can be detected day or night, as long as the amount of energy is large enough to be recorded.

2.1.2.2 Active Remote Sensing

Active remote sensing, on the other hand, emits energy in order to scan objects and areas whereupon a sensor then detects and measures the radiation that is reflected or backscattered from the target. RADAR is an example of active remote sensing where the time delay between emission and return is measured, establishing the location, height, speeds and direction of an object. Active sensors provide their own energy source for illumination. The sensor emits radiation which is directed toward the target to be investigated.

The radiation reflected from that target is detected and measured by the sensor. Advantages for active sensors include the ability to obtain

measurements any time, regardless of the time of day or season.

Active sensors can be used for examining wavelengths that are not sufficiently provided by the sun, such as microwaves, or to better control the way a target is illuminated. (Aronoff, Stan (2005)).

2.2 Geographical information system (GIS)

Geographic information system is defined depending on its components and functions. GIS is a system of computer hardware, software, and procedures designed to support the capture, management, manipulation, analysis, modularity and display of spatially referenced data for solving complex planning and management problems. Generally GIS is defined as a computer based information system that is used to input, store, retrieve, manipulate, analyze and output geographically referenced data or geospatial data, in order to support decision making for planning and management of land use, natural resources, environment, transportation, urban facilities, and other administrative records. (Elshamry Ahmed Salih (2007))

2.2.1 Components of GIS:-

GIS has five components which are: hardware, software, data, people, and procedures.

2.2.1.1 Hardware:-

GIS needs many types of hardware to satisfy some of its main functions such as data collection, storage, manipulation, and presentation. The heart of GIS is the computer which can be a personal computer (PC) or a workstation depending on the volume of the GIS projects and the organization. The choice of the appropriate computer for a particular GIS task depends on the characteristics of the computer. The storage capacity,

compatibility to GIS software and hardware and the speed of the computer are the main characteristics which must be regarded. The storage capacity had been developed rapidly to tens of gigabytes which is adequate for GIS needs.

2.2.1.2 Software :-

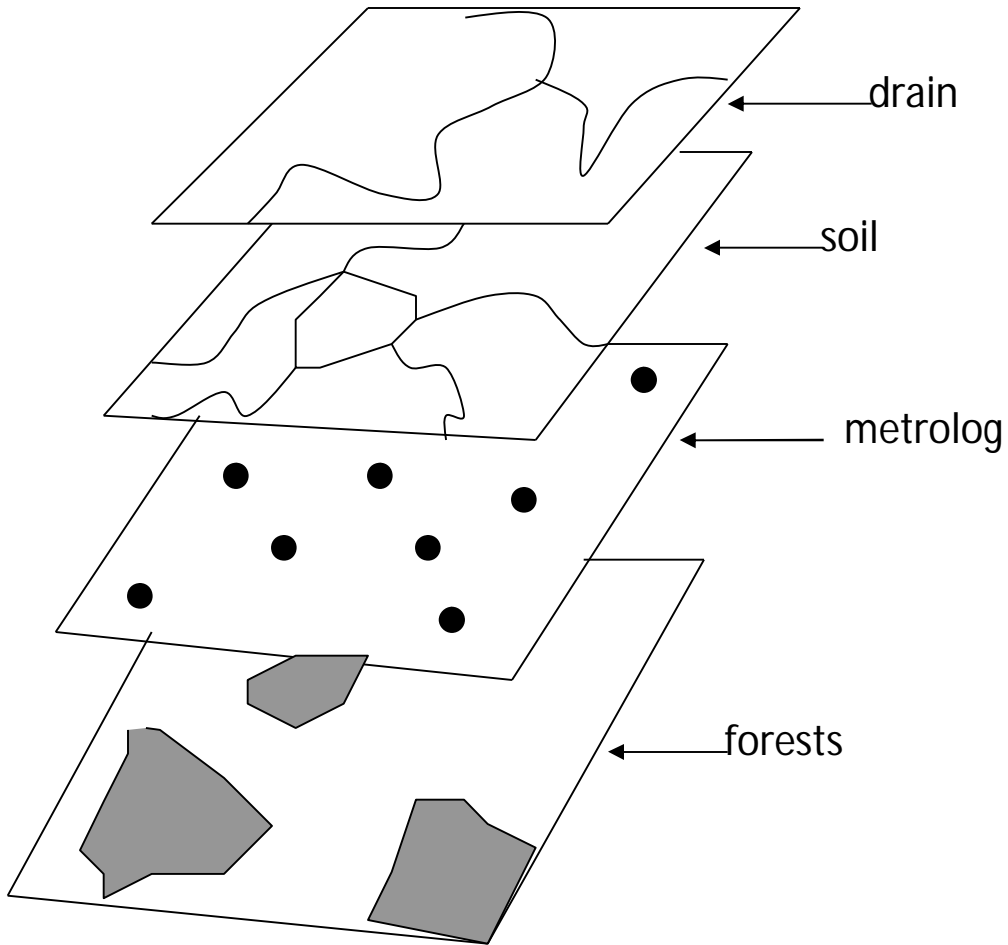
Several comprehensive software systems are developed and fully support GIS applications. GIS has benefited greatly from the rapid, continuous development in the software systems such as operating systems, databases software, computer aided design (CAD) software, multimedia software, internet software, image processing software which are utilized in photogrammetry and remote sensing, and other

software by which survey devices are equipped such as GPS and total station devices. Many organizations and companies concerned with GIS had developed softwares to satisfy different functions of GIS such as those developed by The Environmental Systems Research Institute (ESRI): Arcview, Arcinfo and Arc Gis. Arc Gis is composed of many modules such as Arc Map, Arc Catalogue, Arc Toolbox, Arc Reader, Arc Globe, and Arc Sciene.

2.2.1.3 Data:-

The efficiency of any GIS scheme depends on the quantity and the quality of data. The expected results of analysis are affected directly by the availability, accessibility, reliability, validity, integrity, and completeness of data. Data must be classified in

several classes , such as roads or vegetation type are grouped into layers or cover ages. Layers can be combined to each other in various ways to create new layers that are a function of individual ones.



Figure(2.2) Layers of GIS spatial data

Data collection and processing is the most expensive part of GIS. There are two main types of GIS data: spatial or geographical data and non-spatial data or attributes:-

Spatial data:-

Spatial data describes the absolute or relative location of geographic features. Spatial data is the graphical representation of the geographic locations in a digital form. Spatial data can be obtained from many different sources in a digital form or in a hard copy

Spatial data obtained from existing hard copy maps can be transformed to a digital form by scanners or digitizers. Images produced by aerial photography and remote sensing are informative, cheap, and rapid source of spatial data. Spatial data can be classified into two basic data models: raster data model and vector data model.

1 Raster data model:-

Raster data model, known also as a grid model is a mathematical model. Raster data model is a set of grid of uniform, regular cells. The cell is called pixel which refers to a picture element usually it is rectangular or square but it may be triangular or hexagonal.

2 Vector data model:-

The vector data model represents the geographical phenomena in terms of the spatial components, consisting of points, lines, areas, surfaces and volumes and each layer in the vector data model must be composed of only one component.

3 Topology:-

The geometrical relationships and connections between objects are controlled by topology independent of their coordinates. Topology model is based on mathematical graph theory that deals with the geometrical properties and employs nodes and links. A node can be a point where two lines intersect, an endpoint on a line, or a given point on a line. An arc is a segment of a line between two nodes.

Attributes:-

Attributes are non-graphic data that describe properties of the geographic features or elements represented on the map. Attributes are stored in a table in a manner that each record or row in the table corresponds to geographic object on the map, whereas each property is stored in a column or a field. Each object must have an identity (ID) or access key.

Attribute data models:-

separate data model is used to store and maintain attribute data for GIS software. These data models may exist internally within the GIS software, The most common are: tabular, hierarchical, network, relational and object oriented models.

People or live ware:-

Different levels of people from different disciplines are involved to establish GIS project or organization. People involved in GIS team depend on the

capacity of the organization and the nature of the GIS project, GIS team may include GIS experts, who advise and solve problems for end users .

2.2.1.5 Procedures:-

Procedures include how the data will be retrieved, input into the system, stored, managed, transformed, analyzed, and finally presented in a final output. The procedures are the step taken to answer the question .

2.2.2 Functionalities of GIS:-

Most GIS packages provide functions and tools to enable the execution of different operations necessary for GIS project. There are main five functions as shown with their relationships in figure 6.2 and can be categorized in:-

- (1) Data acquisition.
- (2) Preliminary data processing.
- (3) Data storage and retrieval.
- (4) Spatial search and analysis.
- (5) Graphical display and interaction

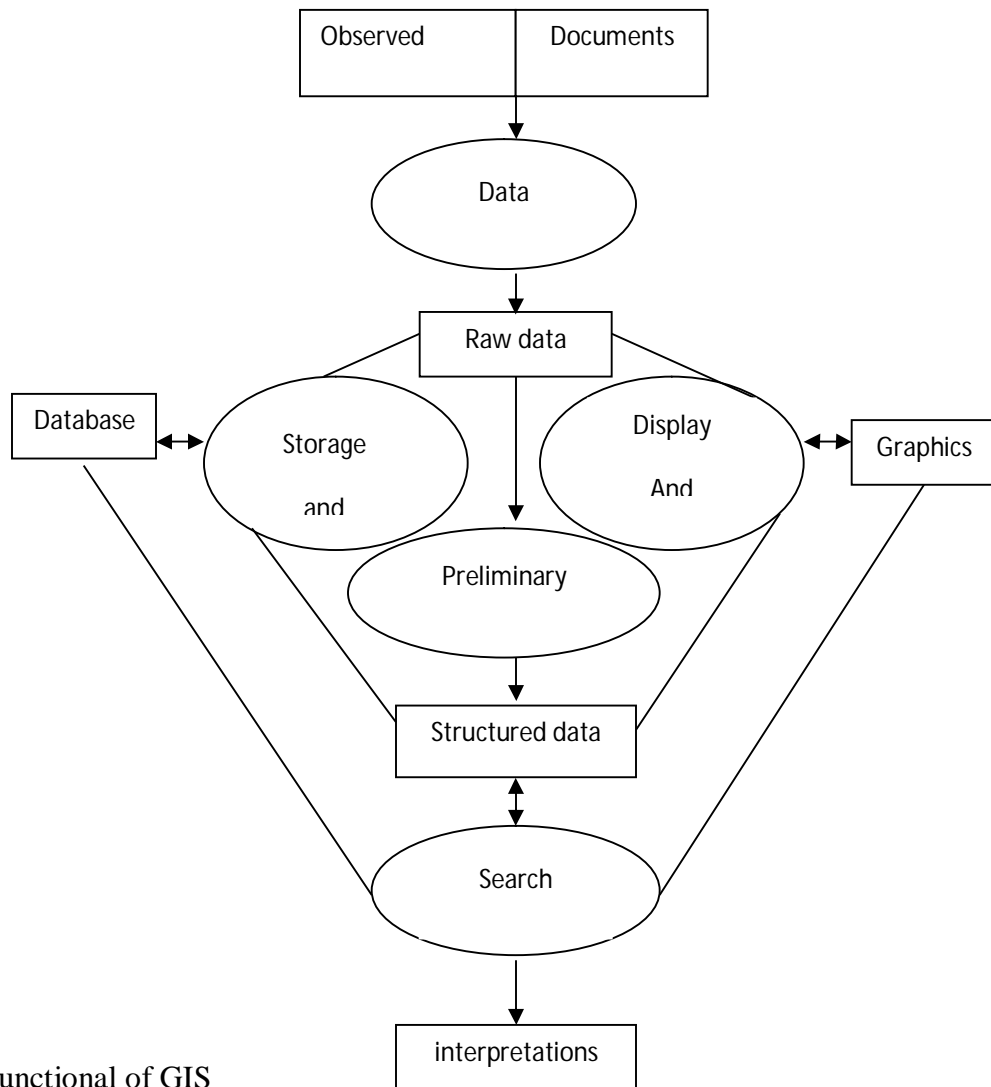


Figure (2.3) Functional of GIS

2.3 Global Mapper

Global Mapper is A viewer capable of displaying the most popular GIS raster ,elevation ,and vector dataset ,allowing users to easily view ,edit and export their data in multiple formats. This help guide will show you how to

2.3.1 Loading a DEM in to Global Mapper

1 When you first open Global Mapper , click on the first option to (open your own data files)In the file browser window that pops –up navigate to the DEM file you wish to open .

- 1 Alternatively , in a separate file directory window you can navigate to your DEM file and click and drag it in to Global Mapper , The DEM should load and you can see the elevation colour ramp .
- 2 Mapper , The DEM should load and you can see the elevation colour ramp .
- 3 Important : setting the project ensures proper measurements ,click on (tool) then (configure) and ensure that the correct projection is set . the projected used should be UTM and correspond to the correct zone . go to the index.

2.3.1View the DEM in 3D

When viewing files with an elevation component ,such as DEM or LIDAR , you can click on the "show 3Dview" button . This will open a 3D View window where you can pan , zoom , and rotate the view using the by clicking on the tool shown here .

2.3.2Create an elevation profile graph .

An elevation profile graph will show you the elevation in a cross section of the DEM . to start ,click on the "3D Elevation profile " button . this will pop-up a "Tip" box , to which you can just click "OK" to . With the cursor click to draw a line across the DEM for which you are interested

2.3.4 Export the DEM to a 3D mesh for use in AutoCAD .

A 3D surface model for use in AutoCAD can be created by exporting the DEM in to DXF mesh . The first step is to roughly zoom in to the area you are interested in exporting . try not to take too much of the mesh .once you are zooming in to the area , click on "file " then "export elevation" this will pop up the "Select Export Format" window From the drop down menu ,select the "DXF " MESH file format then click "OK" .

2.3.5 Export the DEM to a 3D .DXF mesh for AutoCAD

- 1 Next "DXF" Mesh Export Option .box will appear you can change the parameters to whatever suit your dataset ,but you remember to click on the "Interpolate to Fill in small Gaps in the data ".

2 secondly ,click on the "Export bounds" tab then the "DROW ABOX" button to more specifically select your area to export by drawing a box in the pop up window ,everything inside this box will be exported to your mesh .

. 2.3.6 Generating Contours .

1 Contours can be generated easily in global mapper by clicking on File then generate contour . this will open a create generate contour options window .

2 .4 AUTO CAD DROWING

Auto cad LT drafting software help you create , share ,and document your 2D drawings in DWG and other formats .

Get free DWG viewer , to view , open , edit , and convert .dwg files ,the native file format for AutoCAD files .DWG True view include DWG.

This software is more important for drawing program thatf0r export and import throw out the

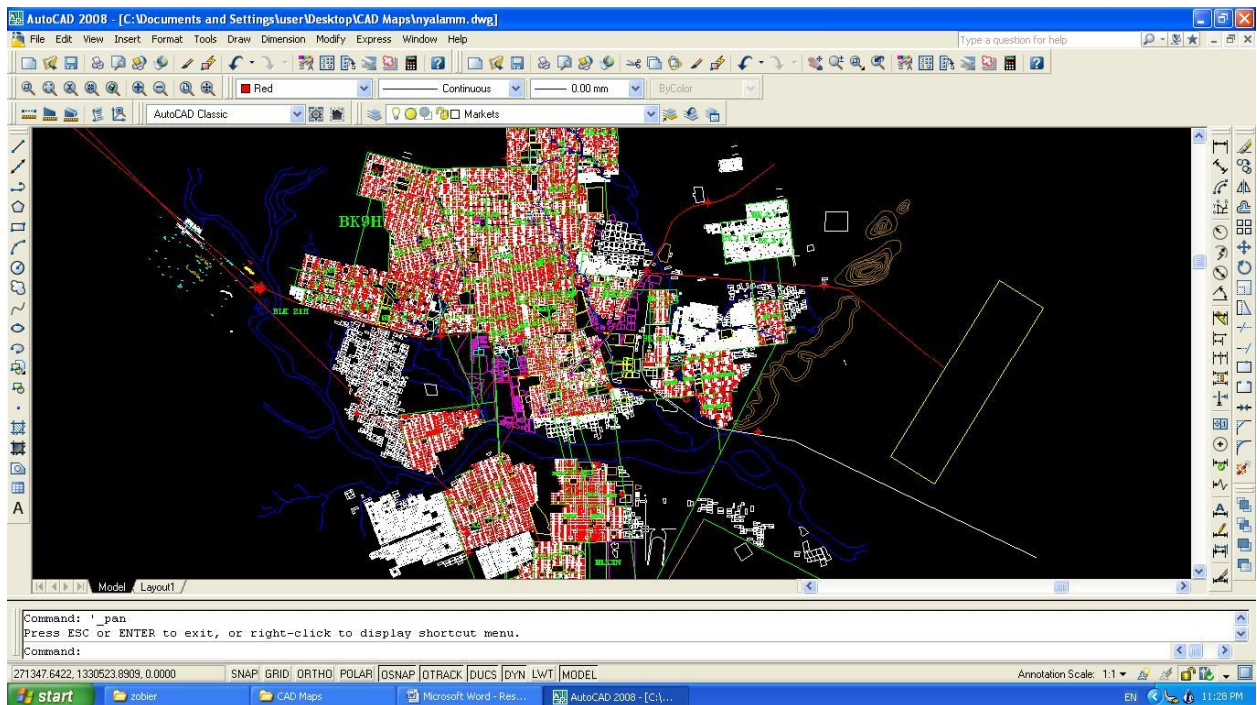


Figure (2.4) represent AutoCAD MAP

2.5 Previews Studies

2.5.1 (Fouda,2013) discusses various procedures that would facilitate controlling the urban space, with a considerable potential in the physical and psychological characters of interspatial gaps and distances between built-up masses. This would positively direct the urban form to a liveable and sustainable character, devoid of various negative conflicts from which the contemporary urban fabric in many cities suffers.

Yasser ElSayed Fouda online: 10 Mar 2014)

2.5. 2 The National Physical Development Plan (NPDP18/04/2016) for the Commonwealth of Dominica ("Dominica") acts together with the National Land Use Policy (NLUP) as the two core documents which fulfill the requirements of the Physical Planning Act. Together the NLUP and NPDP guide planning for land use and development in Dominica.

The last national plan for Dominica, the Dominica National Structure Plan, was developed in 1979. During the creation of the NPDP, the 1979 National Structure Plan was used to provide historical context to the planning of Dominica in past decades. The Dominica National Structure Plan was also used to identify what investments planned for the country might still be relevant today.the entire National Physical Development Plan (NPDP) (PDF, 5.03 MB) document.www.com(Posted: 18/04/2016)

2.5.3 The International World Planning(2016)A townhall meeting will also be held on the Final Draft National Physical Development Plan on November 8th, 2016 at 7:00 p.m. at UWI Open Campus. Public Officers and the general public are invited to participate in these activities and to engage in discussion with Mr. Rory Baksh, Consultant on the National Physical Development Plan, as well as staff at the Planning Division. Your presence will be greatly appreciated.

Also see our events in recognition of International World Planning Day .For more information contact :Physical Planning Division3 Charles Avenue Goodwill

E-mail:physicalplanning@dominica.gov.dm

Website: <http://physicalplanning.gov.dm/> (Posted: 07/11/2016)

2.5.4 The SF State professor Roughly (2016) 7 billion people populate the Earth and they're all dependent on life-sustaining natural resources: food, water and energy. Combine that need with climate change, population growth and economic development and that puts a massive strain on these finite yet vital resources, scientists say. Because the need for one resource is often in direct conflict with another, researchers from varied fields are examining the best ways to sustainably manage water, energy and food, something scientists refer to as the water-energy-food nexus, or simply the nexus.

SF State Associate Professor of Earth and Climate Sciences Jason Gurdak is one of 50 scientists conducting nexus research as part of the Japanese-based Research Institute for Humanity and Nature (RIHN) project. A portion of that research — 20 studies — comprises a newly released special edition of the Journal of Hydrology: Regional Studies, “Water-Energy-Food Nexus in the Asia-Pacific Region.” Gurdak, a groundwater hydrologist and U.S. lead on the project, authored two studies as well as the introduction in the special issue. The RIHN research spans the Asia-Pacific “Ring of Fire” and includes Japan, Indonesia, the West Coast of North America and the Philippines. Website:(<http://physicalplanning.gov.dm/>(2016)

2.5.5 *Jason Gurdak (2015) study said* One of Gurdak's studies examined how climate variability, events like El Niño and La Niña, affect California's groundwater supply. “We found that variability doesn't affect the groundwater in the same way that surface water is affected,” he said. “That has important implications when we have heavy rainfall and snowpack like we did last winter. It's really good for the reservoirs, but it doesn't necessarily result in a lot of natural recharge to aquifers.”

In drought-prone California this research is especially important and could transform policy and management decisions. California's Sustainable Groundwater Management Act went into effect in 2015, giving local agencies authority to manage groundwater. But they have to develop sustainability plans by 2020.

“A lot of the work we're doing right now could be used in developing some of those sustainability plans,” Gurdak said.

The RIHN research explores the connections, relationships, synergies and tradeoffs between water, energy and food resources, so better policies can be developed to sustainably manage them now and into the future, Gurdak said. Studying the nexus could be crucial, particularly during a drought when water resources are scarce, making it harder to grow food, he added.

According to Gurdak, what's unique about the RIHN research is its interdisciplinary approach. "In our project there are hydrologists, biologists, climatologists and oceanographers, but then there are also a lot of social scientists as well — economists, political scientists, environmental lawyers and anthropologists," he said. "You need a broad and diverse perspective. It's also important that these projects include practitioners."

The major challenge for policymakers and researchers is creating management strategies that account for multiple interests, Gurdak added. For example, in the Central Valley groundwater is important for growing crops and sustaining the agricultural economy, but a lot of that groundwater may be used in fracking operations. The issue is getting those different sectors together to think as one system, and hopefully this research will provide some kind of roadmap. Act went into effect in 2015,

(Gurdak 2015 .)

CHAPTER THREE

Characteristic of Study Area

3.1 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 two 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 economy 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 are 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.

3.2 Geographical location of Nyala

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.

3.2.1 Relative location

Nyala located in west Sudan in the north east part of southern Darfur with average altitude 650m above the main 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(3.1) represent the location of Nyala

3.3 Population Distribution

Nyala city is the most populated city in Sudan after Khartoum 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 No(3.1) The population Distribution

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	KarariAlemtidadat	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

Table (2.1)Source:Central Bureau of Statistics South Darfur State The Fifth Census Population 2008

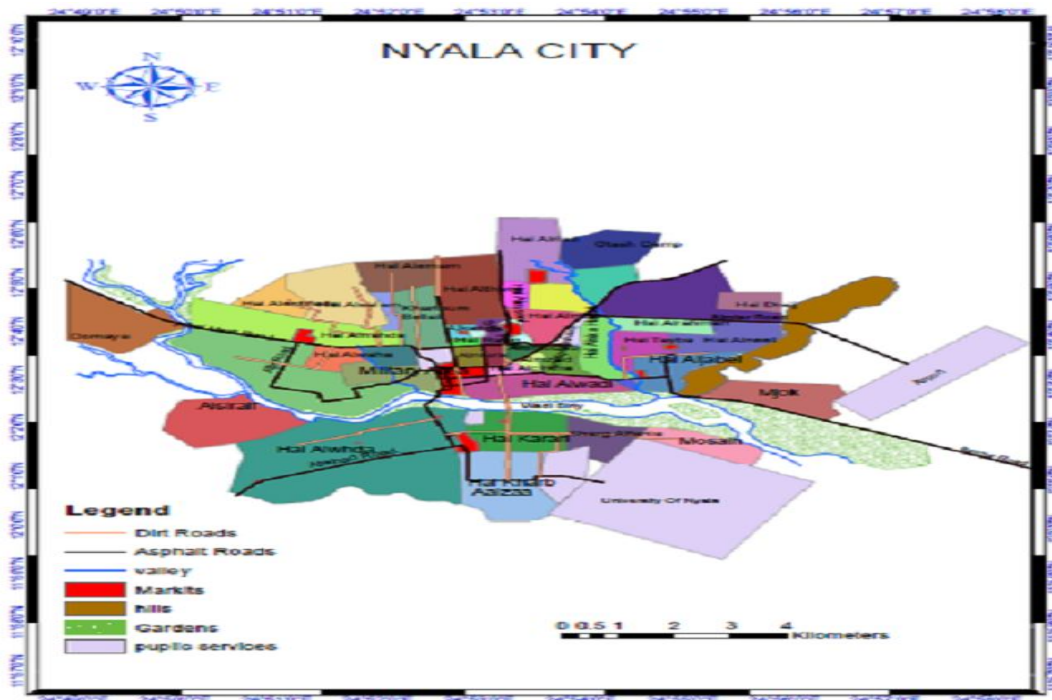


Figure (3.2) Nyala city map

3.4 The Evaluation of an Urban Area of Nyala

An urban area in Nyala is divide in to three types

3.4.1 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.

Table No (3.2) evaluation of an urban area

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

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 areas.

3.4.2 .Market Area

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

3.4.3 .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.

3.5 The effective factors for the developing city

Cities did not originate and evolve spontaneously, but the growth was a result of a number of factors related to the strategic location and position and economic factors relating to production, and political factors associated with the division of administrative.

Nyala was a small village a century ago but it has grown and evolved according to these factors:-

3.5.1 Economical factors:-

a- markets

the markets and the stock exchange of agricultural crops is the biggest commercial activities that attract residents and affect on the demography of the city.

b- Roads

The presence of asphalted roads inside the city in addition to the connection of the other part of Sudan by railway and airport and roads make the reach to the city very easy, this contributed in the increasing and developing of the city.

c- Public services

The concentrating of the educational and health services in Nyala city also effected in the growth of the city.

3.5.2 Political factor:-

The division of Darfur to states made Nyala capital of south Darfur which contributed on the developing of the city, also the immigration of the civilian from conflict places to Nyala during the ongoing war in Darfur surrounded the city by displacements camps.

3.6 Spatial Urban Problems

Although the city attractive to residents and it has all forms of civilization and refinement, but there are many cities are not without problems.

Nyala city as one of the cities which face a lot of urban problems and these problems are as follows:-

a- Low efficiency of water and electricity services as a result of the large increase in population and housing extensions.

- b- The existence of slums around the city and the buildings with mud and fragile local materials that lack of services and public utilities.
- c- Congestion in market area and the lack of transportation stations.
- d- The existence of housing in low lands with poor drainage and face the danger of floods.

CHAPTER FOUR

Data Sources And Methods

This chapter discuss the collected data used and analysis procedures used , in addition to out lines of the analytical methods used to extract information about violence .

4.1 Research Data Set And Sources :

Variety of data were used in this study , the details of the data sets and sources are shown in table (4.1) .

Table (4.1) Data Used in the study

Data	SOURCE
Nyala Digital Map	Ministry of plan South Darfur
Nyala Digital Image	Download from Internet
Nyala Control Points	Ministry of plan South Darfur

4.1.1 Digital Map of Nyala City

Digital Map of Nyala city were used for detecting trespassing and irregularities of urban planning .when matching them together with digital image .

4.1.1.1The main charactrestic of Digital Map of Nyala were as folows .

- Layers : 14 layer as: Schools and University , Road ,Market , Houses , Government , Valies , Railway , Industrial , Hospital , Security , Water center .
- Project and datum : UTM , WGS84 , Zone 35 N .
- References Point : 24 points .
- Control point distribution : well distributed
- Cover size : 25KM *25KM

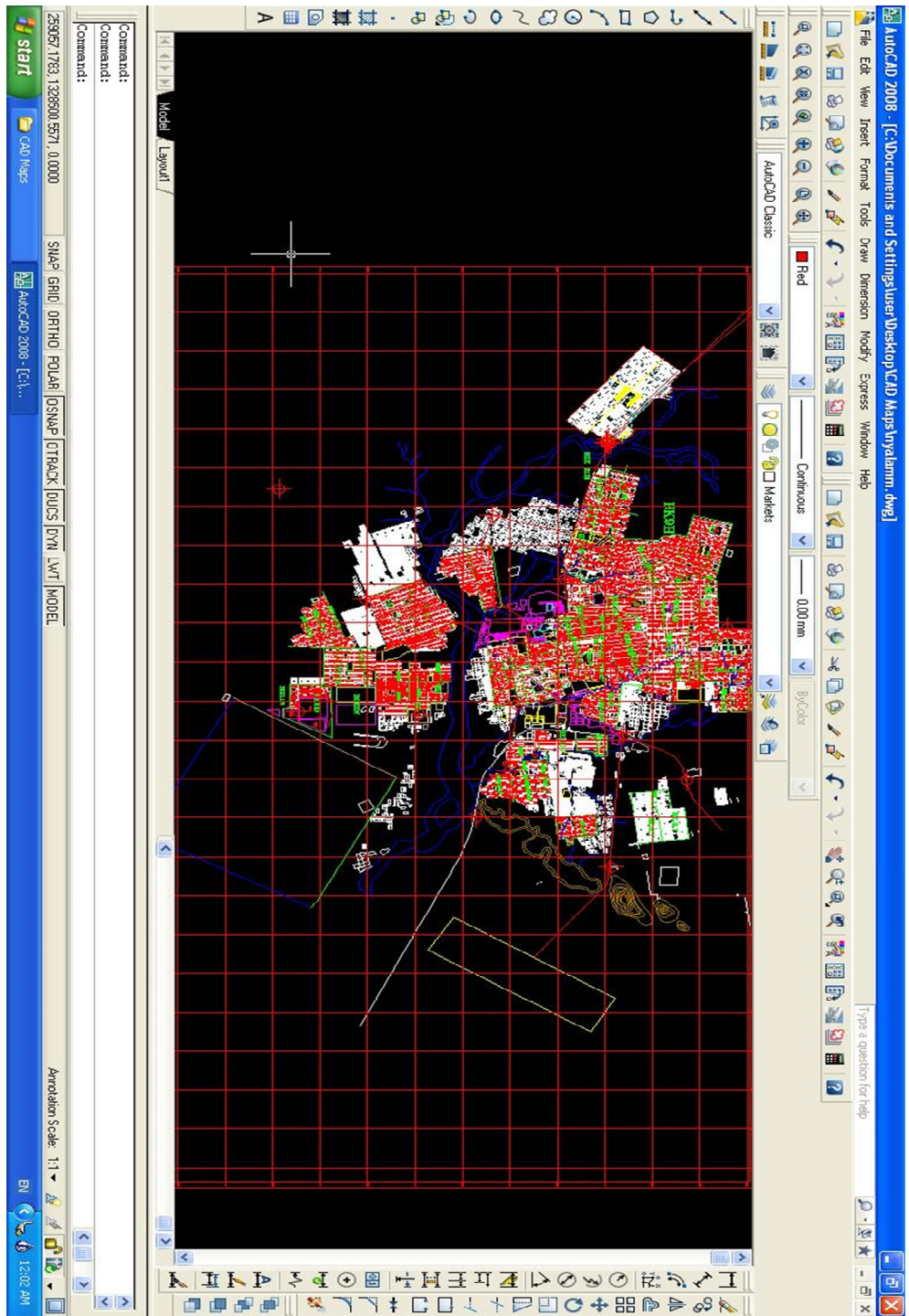


Figure (4.1) Nyala Digital Map

4.1.2 Digital image of nyala

Digital Image of Nyala city was used also for detecting trespassing and irregularities of urban planning

The main charactrestic of Digital image of Nyala were as follows:

- TYPE : TIFF
- Resolution : 0.15 to 0.20 cm.
- Size :80 GB .
- Project and datum :UTM , WGS84 , ZONE 35N .
- Partition : 4 part with 20 GB for everyone .
- Covered area : it cover 25km *25km

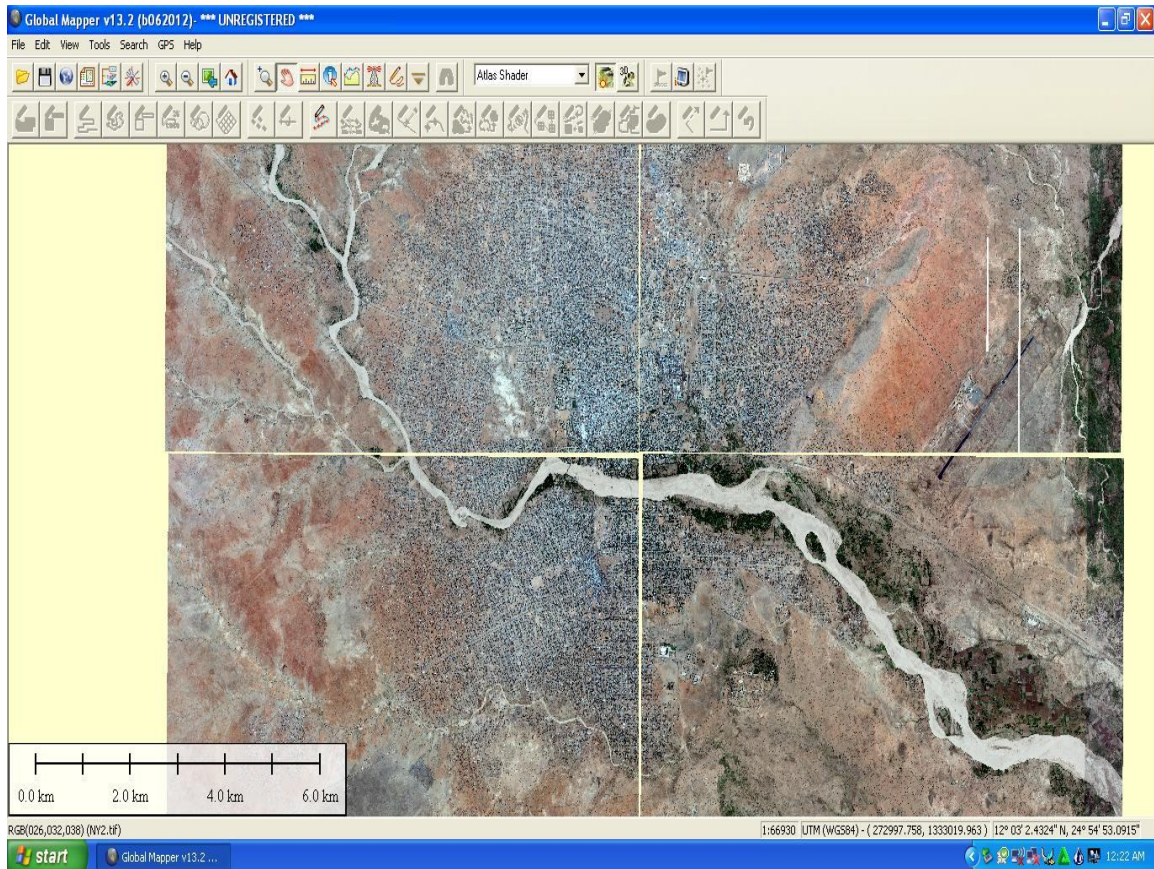


Figure (4.2) Digital image of Nyala

4.1.3 Control point Of Nyala

Control point of Nyala is one of Data source and it is found in the following specification :

Control points is the spatial References that it use to control or put the spatial features in the right place , here we have 24 points of control point , and they are distributed as well distribution throw all blocks of the map . used this point to georeferance the map ,and subset image .This points created by Nyala surveying office ministry of planning south Darfur .

Control points of Nyala City

Number	Elevation	Easting	Northing	Name	
1	662.819	269047.465	1333481.766	NY1	الاقواق
2	669.175	268974.398	1334242.068	NY2	تقاطع شارع الكنفو مع شارع جبل مرة اتجاه الجنوبي الغربي
3	662.443	269996.709	1334370.09	NY3	الركن الجنوبي الغربي لمدرسة نيالا الثانوية بنين
4	673.328	269834.755	1336572.117	NY4	شارع الموشي (الجامع)
5	686.572	274813.49	1335228.103	NY5	المستشفى الإيطالي بشارع المطار
6	668.968	267913.149	1330063.41	NY6	التبدييات الستة (محطة الوقود)
7	655.811	270639.21	1333251.199	SIR7	مدرسة ام المؤمنين شارع الضعين
8	689.092	268669.222	1337684.064	NY8	مدرسة الرحل شارع الكنفو الركن الجنوبي الشرقي
9	670.034	267396.267	1334268.959	NY9	الجهة الشمالية الشرقية لكبري ابوقليب النار حي النهضة مربع 3/ح
10	681.298	265799.621	1334574.891	NY10	الركن الجنوبي الشرقي لمستشفى النهضة
11	678.88	263920.156	1335217.043	NY11	شمال غرب كبري دوماية
12	671.833	265766.709	1332736.023	NY12	آخر محطة الجبر جنوب
13	674.743	266620.443	1332511.748	NY13	الجبر شارع المدارس
14	666.741	267524.726	1331221.736	NY14	تكساس جامع شيخ ابراهيم الركن الجنوبي الشرقي
15	708.273	257727.312	1340128.375	NYA15	كيلو 13 شارع نيالا كاس
16	674.161	265077.088	1328237.88	NYA16	شارع عد الفرسان
17	655.68	270802.933	1328653.308	NYA17	المحجر البيطري
18	650.132	272330.169	1333106.957	NYA18	كبري حي الجبل
19	660.045	272842.649	1333144.883	NYA19	لفة الضعين بحي الجبل
20	648.822	273518.277	1332387.637	NYA20	مدخل مجوك x
21	671.083	273574.978	1335251.046	NYA21	المستشفى السعودي شارع المطار
22	664.43	271385.295	1335503.416	NYA22	تقاطع شارع الفاشر مع شارع المطار اتجاه الشمال الشرقي
23	670.96	272568.633	1336826.823	NYA23	الميناء البري
24	655.117	270883.701	1331183.486	NY24	جنوب شرق مسجد المدرسة الفنية

Table(4.2)Control points Names

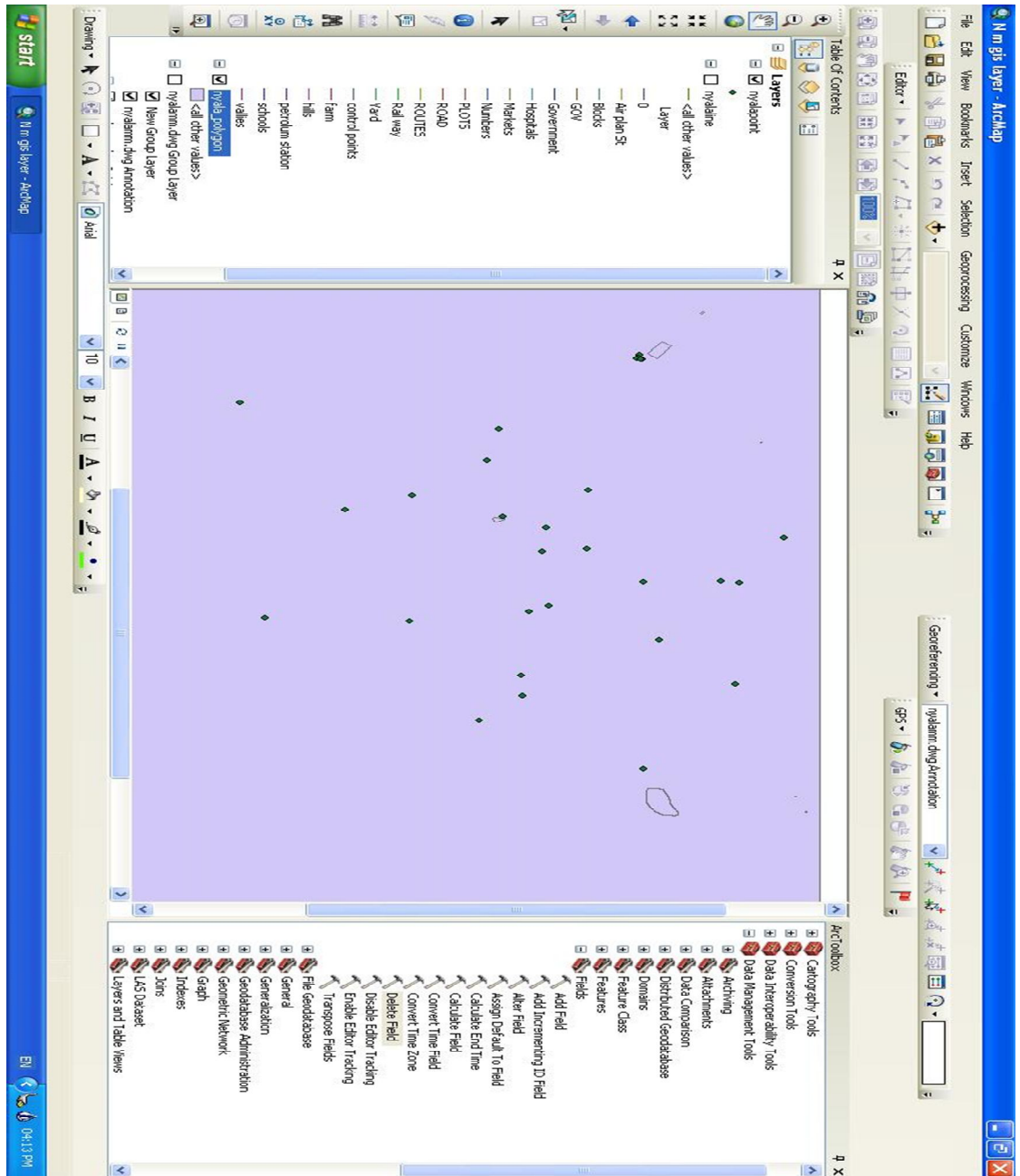


Figure (4.4) Control points distribution

4.2 Software Used

Different types of software used in this study to detect and analyze the irregularities and trespassing in Nyala city .

- (a) AutoCAD Software was used to Creating Map Layers cover all study Area .
- (b) Erdas Image Software(Remote Sensing) was used to Mosaic all maps to create one map ,and Subset Image .
- (c) Arc Map Software (GIS) was used to transformation map Form Autocad to GIS and view(match) the map and Image together .
- (d) Global Mapper Software was used to view and display these data .

4.3 Methodology

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

Data Collection .(Digital Map ,Digital Image ,Control Points)

- 1 Combination Maps and Create Layers .
- 2 Transformation map from AutoCAD to GIS .
- 3 Download Image and Mosaic in Erdas
- 4 Georeferancing the Image with control points in GIS.
- 5 Review Image with control points .
- 6 Matching Image with full map(complete) .
- 7 Matching Image with map layers (one by one) .
- 8 Detecting Samples of Trespassing .
- 9 Detecting Samples of Irregularities .
- 10 Detecting Samples of Over lapping .
- 11 Creating trespassing and irregularities Layer and table of distend and bearing and coordinate between center point and trespassing .

The methodology represented by Flow Chart as: data collection (Digital map, image control points) combine maps and create layers, download image from internet ,measure control points with (GPS) .

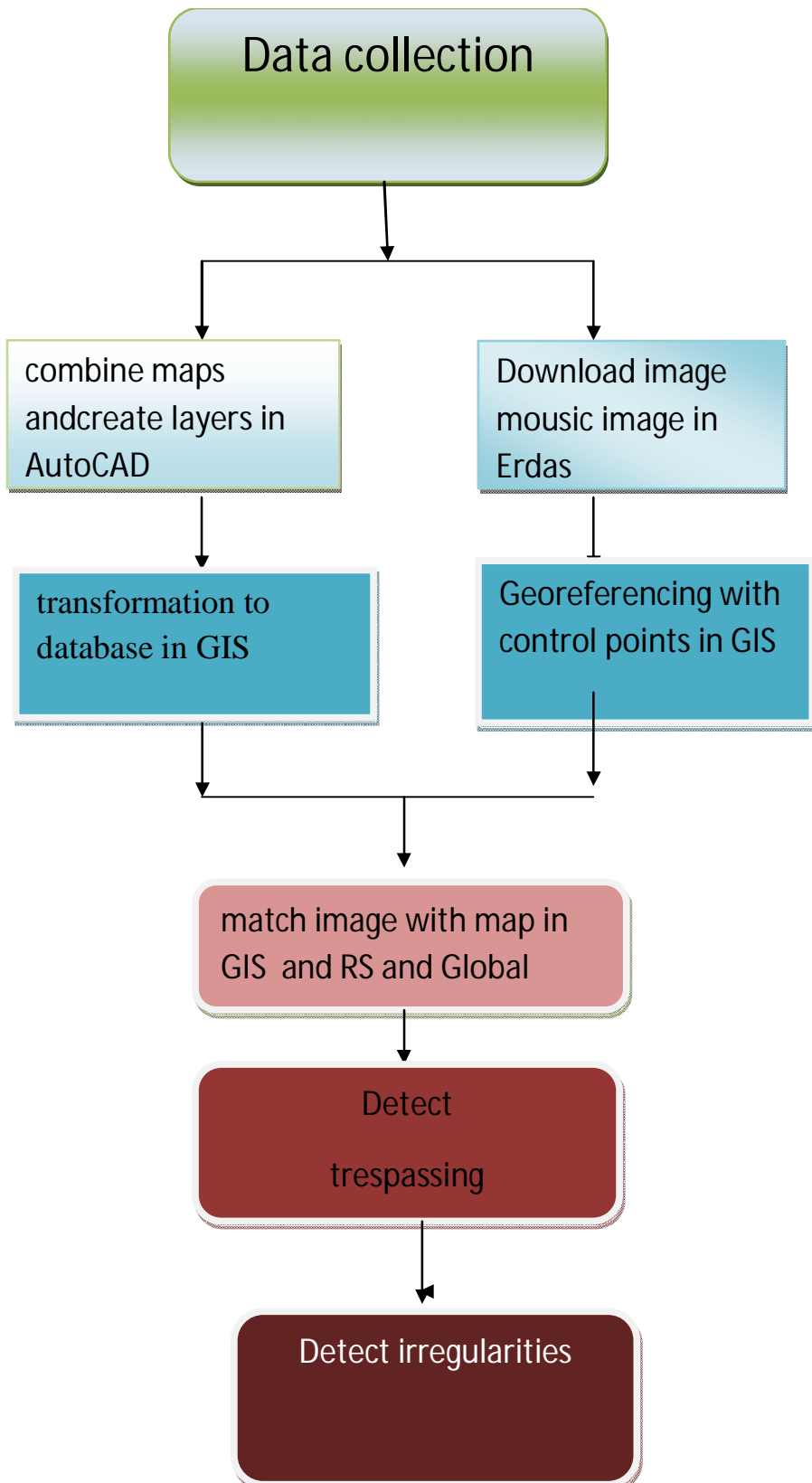


Figure (4.5) methodology Flow Chart of the study

4.3.1 Combination Maps and Create Layers

Study area has 41 neighborhood residential maps in blocks this were be combined to create full map ,then create layers as fl

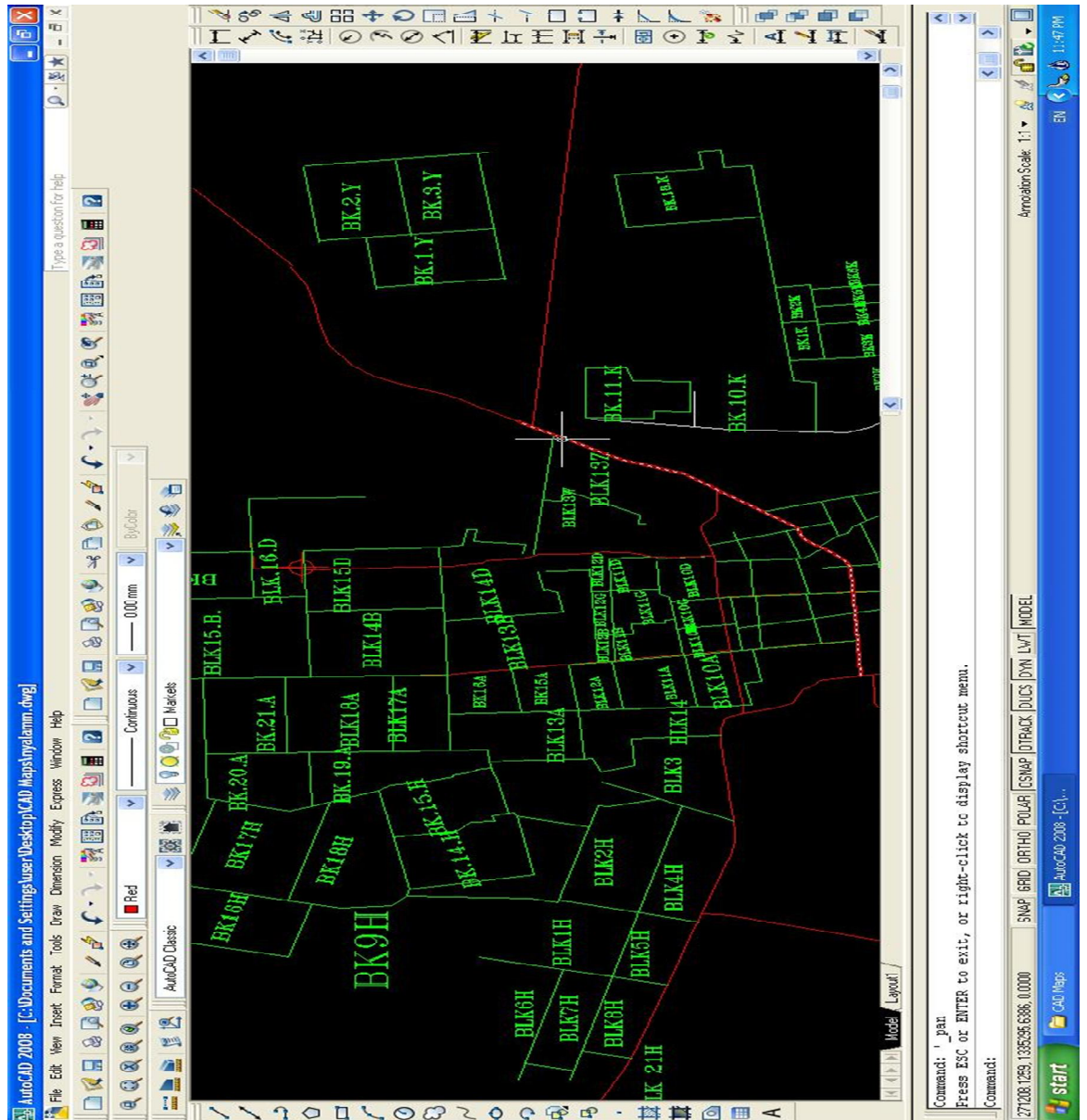


Figure (4.6) Layer of Blocks(AUTOCAD)

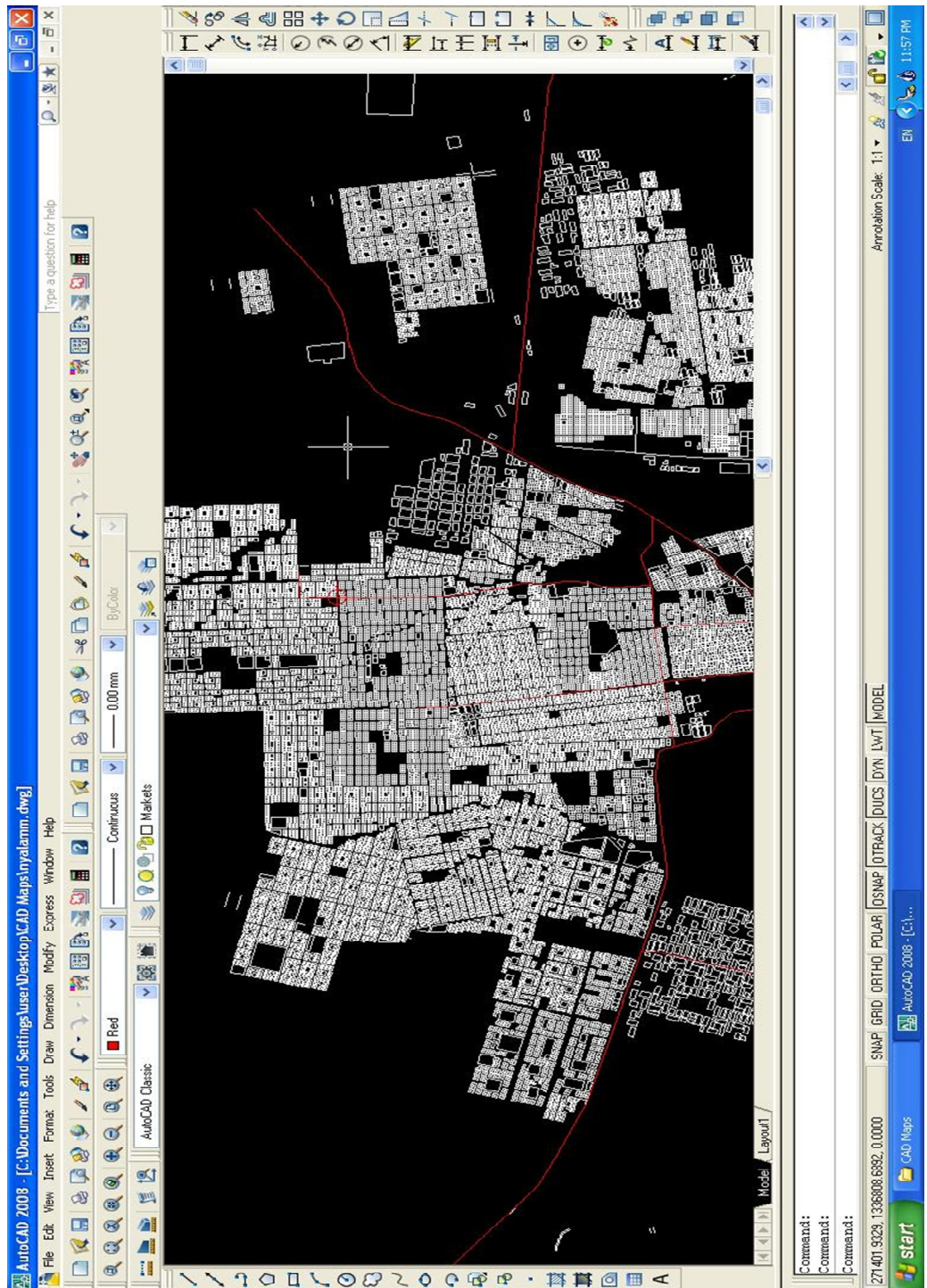


Figure (4.6) Layer of Residential area(AUTOCAD)

4.3.2 Transformation map from AutoCAD to GIS

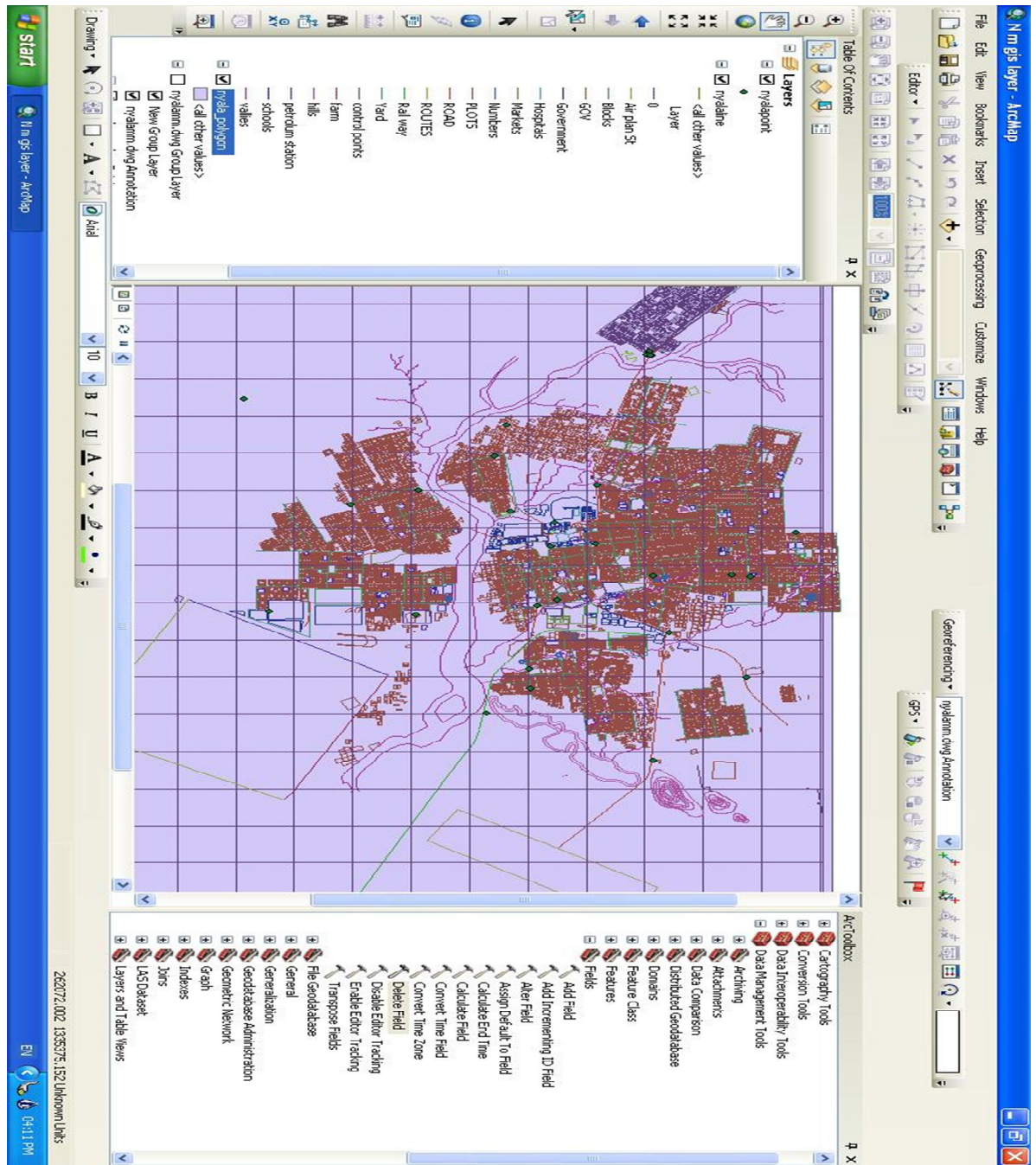


Figure (4.7) Transformation Lines layer in GIS

4.3.3 Detecting Samples of Trespassing .

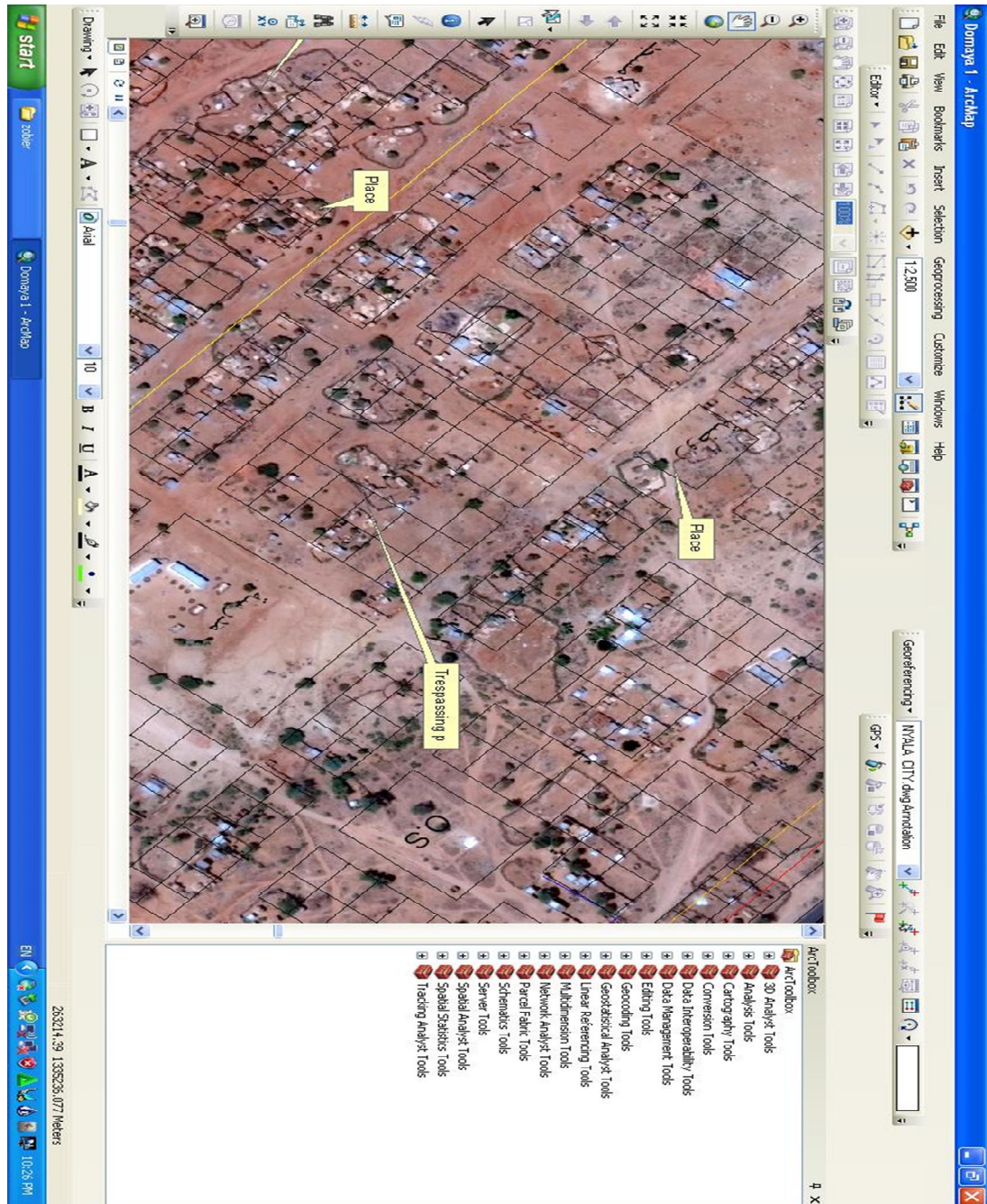


Figure (4.8) Detecting Samples of Trespassing

4.3.4 Georeference the image with control points

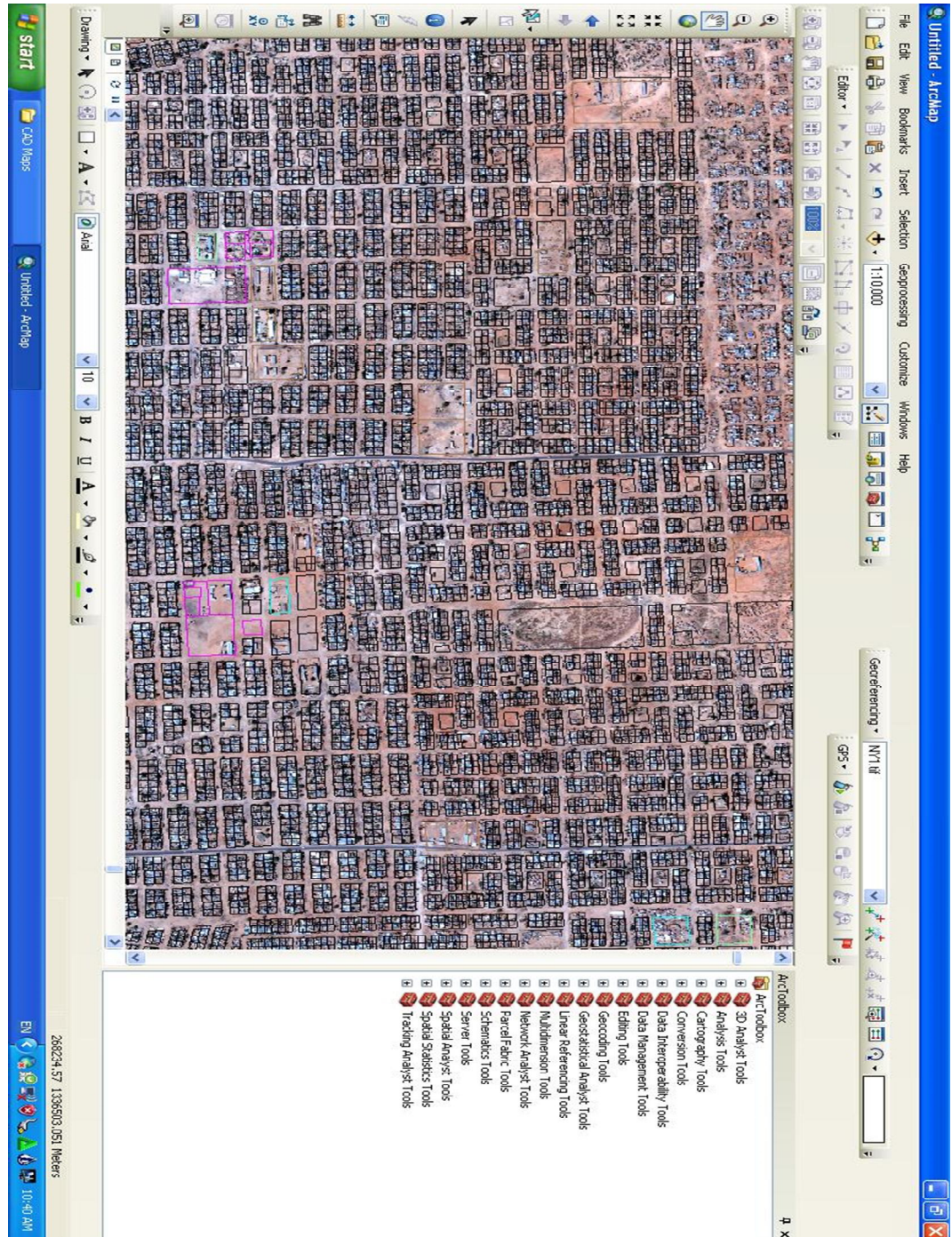


Figure (4.8) Georeferencing image with control points

4.3.5 Detecting Samples of Irregularities



Figure (4.8) Irregularities Areas Road

CHAPTER FIVE

Results and Analysis

5.1 Introduction

This chapter contains analysis of measurement which 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.

5.2 Results

5.2.1 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 .

5.2.2 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).

5.2.3 Verification the irregularities in the Government reserve and services Area . This kinds are found in un builded area like Hospital , Market , public yard , then take sample in Block (17D) , (4Y) ,(4LG).

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

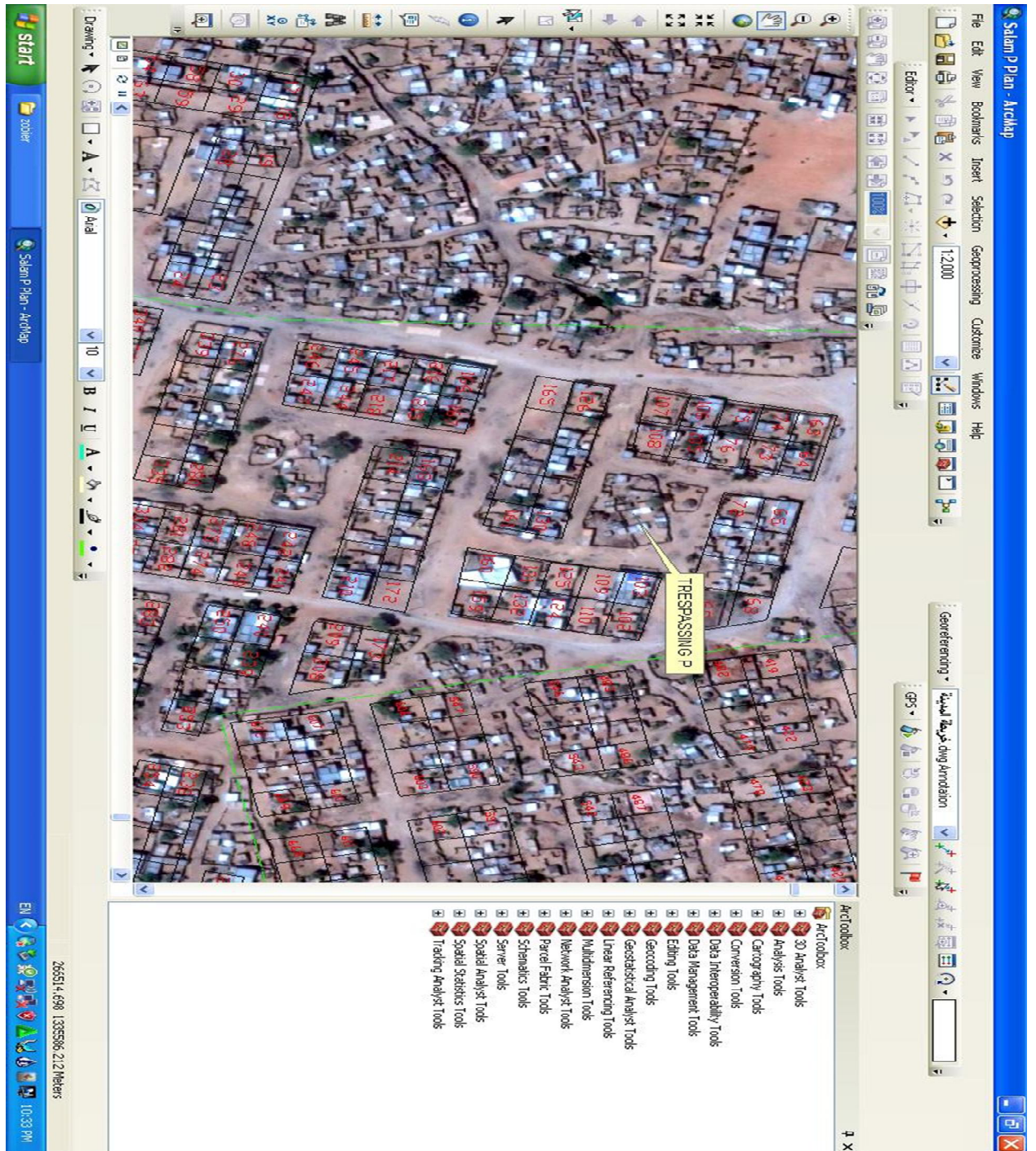


Figure (5.1) Trespassing Areas Open space

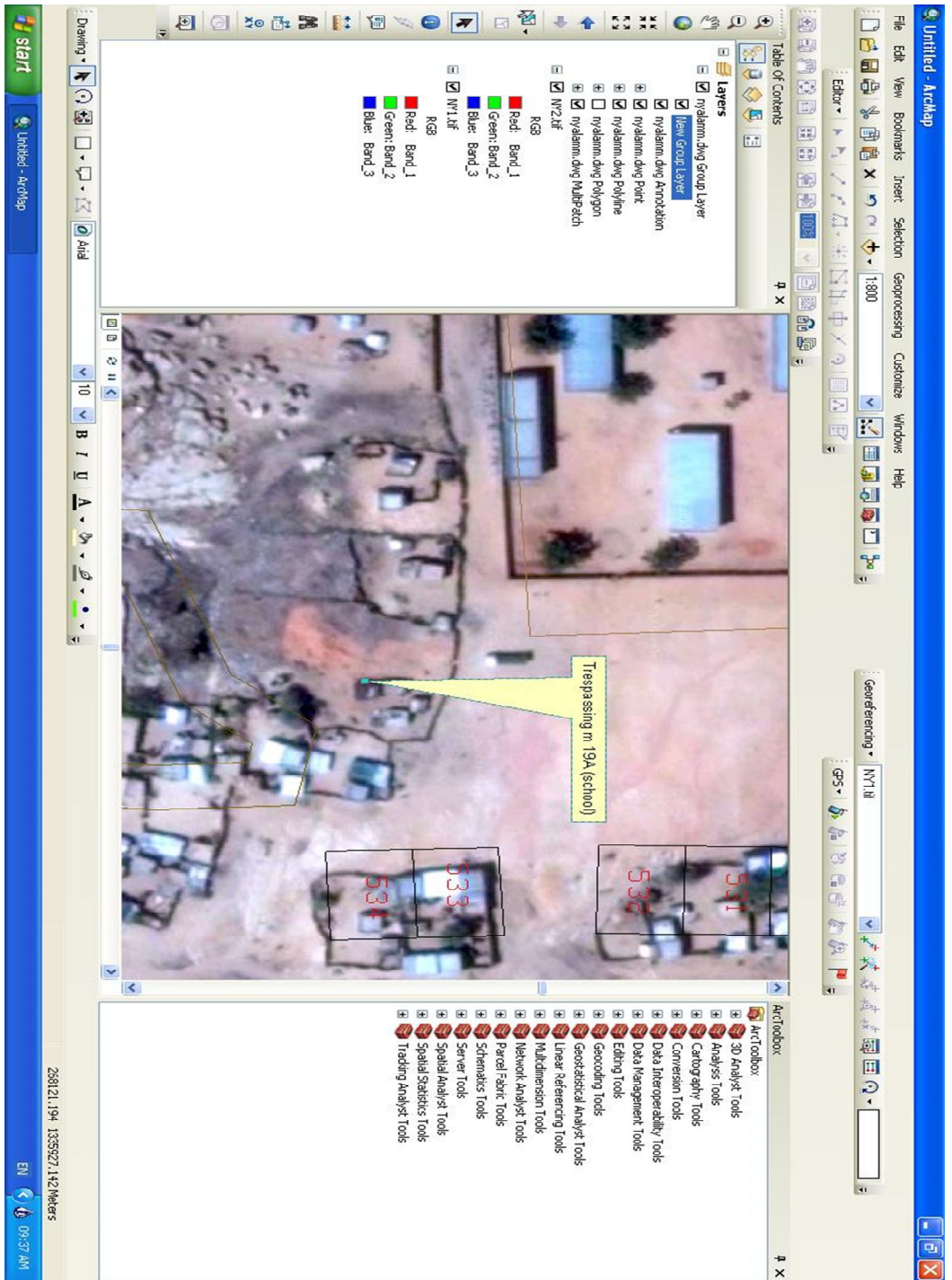


Figure (5.5) irregularities Areas School

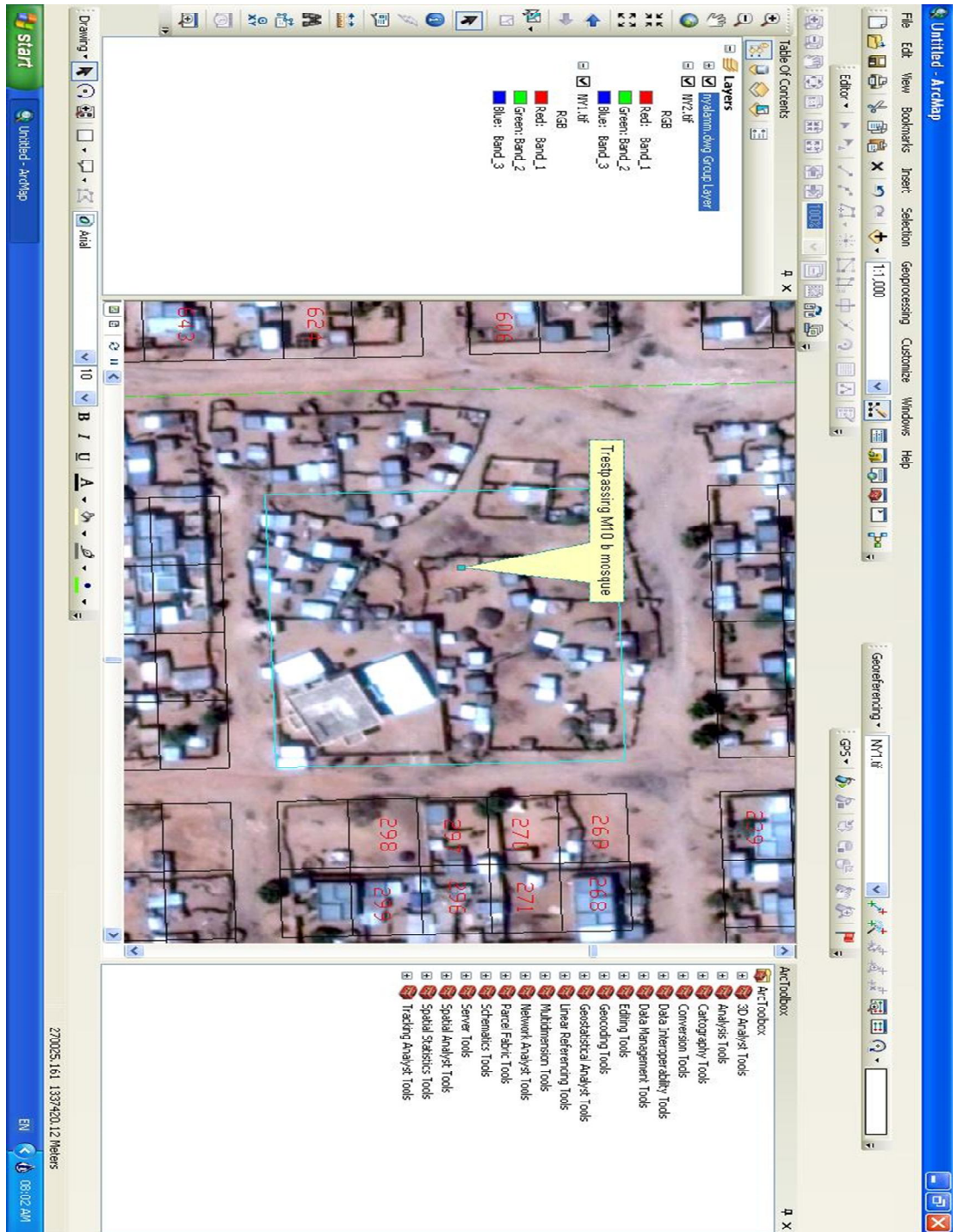


Figure (5.6) Trespassing Areas play ground

5.3 Analysis

5.3.1 Verification a distance , bearing and coordinate between the center point (survey office) and trespassing and irregularities . distance and bearings of trespassing areas were calculated using network analysis in Arc GIS in addition to coordinates

5.3.1.1 Creating table of distance , bearing and coordinates

To create table of distance 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 (4.2) distance , bearing and coordinate

OBJECTID	IN_FID	NEAR_FID	NEAR_DIST	NEAR_RANK	FROM_X	FROM_Y	NEAR_X	NEAR_Y
1	0	1	640.571153	1	269032.204888	1333490.21464	268394.310853	1333548.717649
2	0	2	640.571153	1	269032.204888	1333490.21464	268394.310853	1333548.717649
3	0	6	763.804895	2	269032.204888	1333490.21464	268959.137888	1334250.51664
4	0	11	763.804895	2	269032.204888	1333490.21464	268959.137888	1334250.51664
5	0	3	1169.302417	3	269032.204888	1333490.21464	268095.938237	1332789.734161
6	0	5	1447.73691	4	269032.204888	1333490.21464	270476.5095	1333589.845696
7	0	26	1624.682709	5	269032.204888	1333490.21464	270639.21	1333251.199
8	0	24	1811.832098	6	269032.204888	1333490.21464	267396.267	1334268.959
9	0	28	1914.247276	7	269032.204888	1333490.21464	269834.755	1335228.103
10	0	21	2602.68945	8	269032.204888	1333490.21464	266620.443	1332511.748
11	0	20	2723.690133	9	269032.204888	1333490.21464	267524.726	1331221.736
12	0	12	2957.876751	10	269032.204888	1333490.21464	270883.701	1331183.486
13	0	13	2957.876751	10	269032.204888	1333490.21464	270883.701	1331183.486
14	0	16	2957.876751	10	269032.204888	1333490.21464	270883.701	1331183.486
15	0	0	3090.714777	11	269032.204888	1333490.21464	271370.034888	1335511.86464

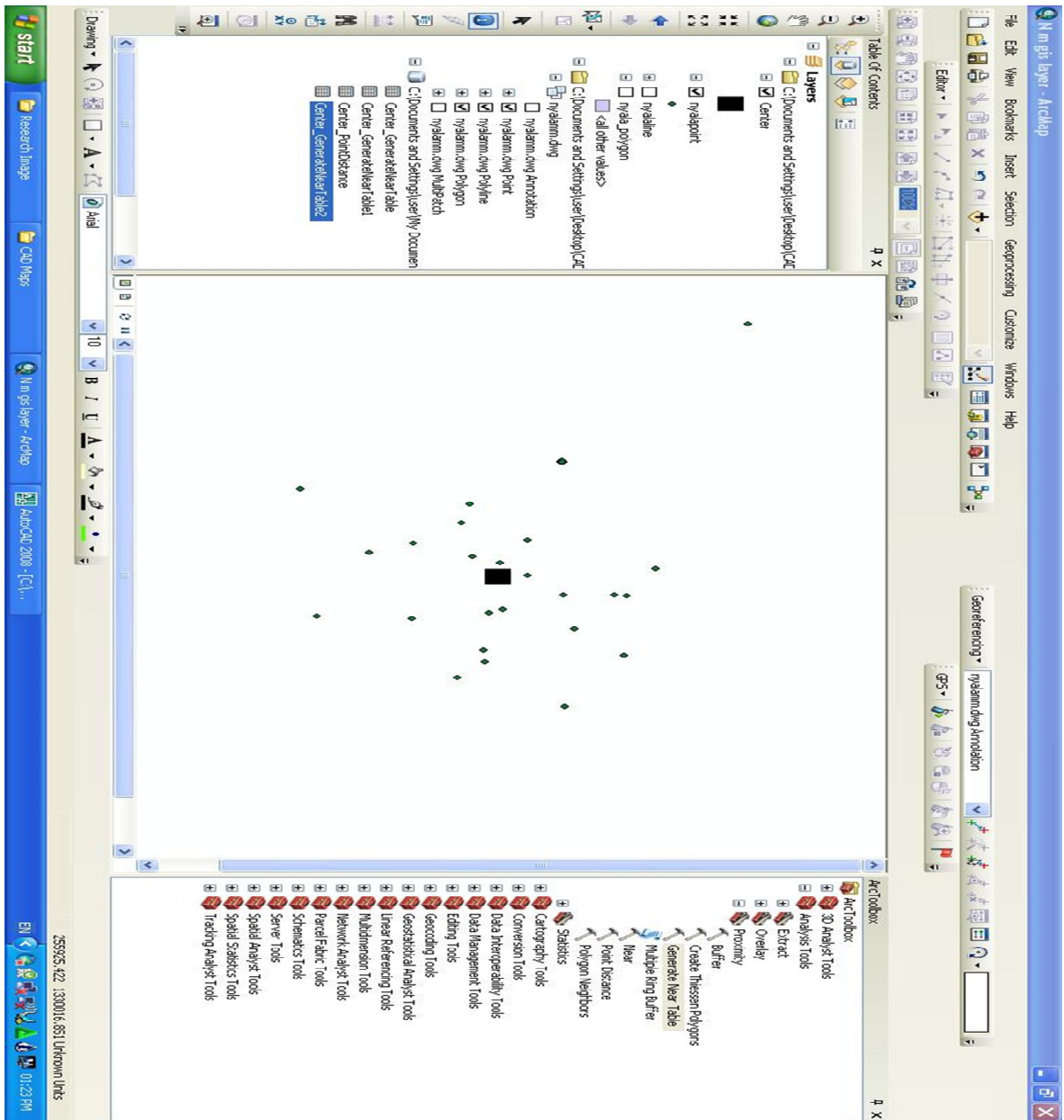


Figure (5.8) center point and trespassing and irregularities areas

CHAPTER SIX

Conclusion and Recommendation

6.1 Conclusion

The Research Study is Summaries as follows :

1 -the professional software used are Remote Sensing (Erdas) , 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 from internet download and Digital Map of Nyala from Ministry of planning South Darfur then detected the following :

- A- Houses boundaries and buildings irregularities .
 - B- Open spaces and public areas trespassing .
 - C- Percentage of trespassing and irregularities .
- 2 -Determinate distend , bearing and coordinate between the center point (survey office) and trespassing , irregularities areas using GIS tools (network analysis).
- 3 The study fine that the irregularities can be detected efficient by the mentioned tools .
- 4 The study building Geodatabase for Nyala city .

6.2 The recommendation

The study recommends:

1 -Usage of GIS and R.S technique to establish comprehensive digital form to : record , storage , update ,manage ,manipulate , mosaic presentation , process , and analyze of the data which collected from study . Activate the laws and regulations of physical planning to remove irregularities and trespassing to enable supply of services .

2 - Sharing of data between different sectors of services and building monitoring .

3-usage the high resolution satellite images to monitor the implementation of construction building according to the conditions stated in laws and regulation.

4- the continued researches in this field to find ways to examine the rest of the irregularities which have not been studied in this research .

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