BHUBANESWAR SMART CITY USING GIS

A Report

Submitted in partial fulfilment of the requirements
For the degree of

Bachelor of Technology
In
Civil Engineering

By
SOUMYA RANJAN PATTANAYAK
(Regd. No. 2021298025)

AVAYA HIRA
(Regd. No. 2021298006)

MICKEY LUGUN
(Regd. No. 2021298017)

UJJAWAL DUBEY
(Regd. No. 2021298034)

Under the guidance of
PROF. Sitaram Satapathy

DEPARTMENT OF CIVIL ENGINEERING
GANDHI INSTITUTE FOR TECHNOLOGY, AUTONOMOUS
BHUBANESWAR-752054 2022-23

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Department Of Civil Engineering

Gandhi Institute of Technology,
Autonomous
Bhubaneswar – 752054, Odisha, India
(Approved by AICTE & Govt. of Odisha and affiliated to BPUT)
www.gift.edu.in

CERTIFICATE

This is to certify that the thesis entitled "**Bhubaneswar Smart City Using GIS**" submitted by **UJJAWAL DUBEY (2021298034), SOUMYA RANJAN PATTANAYAK (2021298025), AVAYA HIRA (2021298006), MICKY LUGUN (2021208017)** in partial fulfilment of the requirements for the award of **Bachelor of Technology Degree** in **Civil Engineering** at Gandhi Institute For Technology, Bhubaneswar is an authentic work carried out by him under my supervision and guidance.

To the best of my knowledge, the matter embodied in this Project Report has not been submitted to any other University/Institute for the award of any Degree or Diploma.

Sitaram Satapathy

Project Guide
Dept. of Civil Engineering

S. Pattnaik 31/5/23

Head Dept. of Civil Engineering

31/5/23

Project Coordinator
Dept. of Civil Engineering

31/5/23

External

DECLARATION

We declare that this project report titled " **BHUBANESWAR SMART CITY USING GIS** "submitted in partial fulfilment of the Degree of B.Tech in Civil Engineering is a record of original work carried out by us under the supervision of **Prof. Sitaram Satapathy**, and has not forward the basis for the award of any other degree or Diploma, in this or any other institutions or University. In keeping with the ethical practice in reporting scientific information, due acknowledgements have been made wherever the findings of others have been cited.

UJJAWAL DUBEY
Regd. No. 2021298034

SOUMYA RANJAN PATTANAYAK
Regd. No. 2021298025

AVAYA HIRA
Regd. No. 2021298006

MICKEY LUGUN
Regd. No. 2021298017

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UJJAWAL DUBEY
Regd. No. 2021298034

SOUMYA RANJAN PATTANAYAK
Regd. No. 2021298025

AVAYA HIRA
Regd. No. 2021298006

MICKEY LUGUN
Regd. No. 2021298017

ABSTRACT

National Smart Cities Mission is an urban renewal and retrofitting program by the Government of India with the mission to develop smart cities across the country, making them citizen friendly and sustainable. The Union Ministry of Urban Development is responsible for implementing the mission in collaboration with the state governments of the respective cities. * "100 Smart Cities Mission" was launched by Prime Minister Narendra Modi on 25 June 2015. A total of ₹98,000 crore (US$12 billion) was approved by the Indian Cabinet for the development of 100 smart cities and the rejuvenation of 500 others. ₹48,000 crore (US$6.0 billion) for the Smart Cities mission and a total funding of ₹50,000 crore (US$6.3 billion) for the Atal Mission for Rejuvenation and Urban Transformation (AMRUT) have been approved by the Cabinet. The first batch of 20 cities was selected. Known as 20 Lighthouse Cities in the first round of the All India City Challenge competition, they will be provided with central assistance of ₹200 crore (US$25 million) each during this financial year followed by ₹100 crore (US$13 million) per year during the next three years. The Urban Development Ministry had earlier released ₹2 crore (US$250,000) each to mission cities for preparation of Smart City Plans.Bhubaneswar's proposal envisions to retrofit and redevelop 985-acres centered around main Railway Station in heart of the city to a vibrant 24x7 destination- The Bhubaneswar Town Centre District (BTCD). Bhubaneswar's state-of-the-art Intelligent City Operations and Management Centre (ICOMC) is at the core of its pan-city proposal.

CONTENTS

LIST OF FIGURES

ABBREVIATIONS

AMRUT – ATAL MISSION FOR REJUVENTION & URBAN TRANSFOTRMATION

ICTs – INFORMATION & COMMUNICATION TECHNOLOGIES

GIS – GEOGRAPHICAL INFORMATION SYSTEN

SI – SATELLITE IMAGE

IOT – INTERNET OF THINGS

SC – SMART CITY

MIS – MANAGEMENT INFORMATION SYSTEM

UTM – UNIVERSAL TREANSVERSE MERCATOR

SCP – SMART CITY PROPOSAL

BSCL – BHUBANESWAR SMART CITY LITITED

ARS – ACTIVE REMOTE SENSING

PRS – PASSIVE REMPOTE SENSING

MoUD – MINISTRY OF URBAN DEVELOPMENT

SPV – SPEACIAL PURPOSE VEHICLE

ULB – URBAN LOCAL BODIES

CC – CLOUD COMPUTING

SOP – STANDARD OPERATING PROCE

CHAPTER I

INTRODUCTION

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Smart Cities Mission

National Smart Cities Mission is an urban renewal and retrofitting program by the Government of India with the mission to develop smart cities across the country, making them citizen friendly and sustainable. The Union Ministry of Urban Development is responsible for implementing the mission in collaboration with the state governments of the respective cities. The mission initially included 100 cities, with the deadline for completion of the projects set between 2019 and 2023. The effective combined completion of all projects as of 2019 is at 11%. As of March 2022, 3577 projects out of total 6939 tendered projects have been completed, utilizing ₹60,073 crore out of total tendered amount of ₹191,294 crore.

Description

Smart Cities Mission envisions developing an area within the cities in the country as model areas based on an area development plan, which is expected to have a rub-off effect on other parts of the city, and nearby cities and towns. Cities will be selected based on the Smart Cities challenge, where cities will compete in a countrywide competition to obtain the benefits from this mission. As of January 2018, 99 cities have been selected to be upgraded as part of the Smart Cities Mission after they defeated other cities in the challenge.

It is a five-year program in which, except for West Bengal, all of the Indian states and Union territories are participating by nominating at least one city for the Smart Cities challenge. Financial aid will be given by the central and state

governments between 2017–2022 to the cities, and the mission will start showing results from 2022 onwards.

Each city will create a Special Purpose Vehicle (SPV), headed by a full-time CEO, to implement the Smart Cities Mission. Centre and state government will provide ₹1,000 crore (US$130 million) funding to the company, as equal contribution of ₹500 crore (US$63 million) each. The company has to raise additional funds from the financial markets.

History

100 Smart Cities Mission" was launched by Prime Minister Narendra Modi on 25 June 2015. A total of ₹98,000 crore (US$12 billion) was approved by the Indian Cabinet for the development of 100 smart cities and the rejuvenation of 500 others. ₹48,000 crore (US$6.0 billion) for the Smart Cities mission and a total funding of ₹50,000 crore (US$6.3 billion) for the Atal Mission for Rejuvenation and Urban Transformation (AMRUT) have been approved by the Cabinet. In the 2014 Union budget of India, Finance Minister Arun Jaitley allocated ₹7,016 crore (US$880 million) for the 150 smart cities. However, only ₹924 crore (US$120 million) of the allocated amount could be spent until February 2015. Hence, the 2015 Union budget of India allocated only ₹143 crore (US$18 million) for the project.

The first batch of 20 cities was selected. Known as 20 Lighthouse Cities in the first round of the All India City Challenge competition, they will be provided with central assistance of ₹200 crore (US$25 million) each during this financial year followed by ₹100 crore (US$13 million) per year during the next three years. The Urban Development Ministry had earlier released ₹2 crore (US$250,000) each to mission cities for preparation of Smart City Plans.

Smart City Challenge

The Ministry of Urban Development (MoUD) program used a competition-based method as a means for selecting cities for funding, based on an area-based development strategy. Cities competed at the state level with other cities within the state. Then the state-level winner competed at the national level Smart City Challenge. Cities obtaining the highest marks in a particular round were chosen to be part of the mission.

The state governments were asked to nominate potential cities based on state-level competition, with overall cities across India limited to 100. In August 2015 the Ministry of Urban Development released the list of 98 nominees sent in by state governments.

All the participating cities from West Bengal (New Town, Kolkata, Bidhannagar, Durgapur, Haldia) have withdrawn from the Smart Cities Mission. Mumbai and Navi Mumbai from Maharashtra have also been withdrawn from the Smart Cities Mission.

History of Bhubaneswar :-

Bhubaneswar : The Temple City of India

Bhubaneswar is one of the famed cities of Odisha; it is the capital of the state. The city is among one of the oldest cities of India, finding its origin around the 2nd century B.C during the Chedi dynasty. Bhubaneswar got its name from Tribhubaneswar meaning Lord Shiva. Since the establishment of the city, Bhubaneswar has been known by different names; Toshali, Nagar Kalinga, Kalinga Nagar, Ekamra Kanan, Mandira Malini Nagar are a few. The City of Temples is the largest city in Odisha, serving to be one of the centres of

religious and economic importance in Eastern India.

Kalinga architecture spans the entire city. Bhubaneswar together with Konark and Puri forms the Swarna Tribhuja or Golden Triangle, the most visited destinations in Odisha. In 1948, Bhubaneswar replaced Cuttack as the capital of the state. German architect Otto Kongisberger then designed the city in 1946. It is considered as one of the first planned cities of modern India along with Chandigarh and Jamshedpur. In modern India, Bhubaneswar is a Tier 2 city, developing quickly as one of the education hubs. It caters to more than 1.4 million people toda

Ancient Bhubaneswar

Bhubaneswar has a long line of history and it dates back to the 1st and 2nd century. Before the modern city emerged, the old city was of vital importance. The various historical monuments in and around the city are evidence of that. The first mention of the city was made during the Kalinga war. Other than Hindu temples, there are Jain and Buddhist temples carved during Ashokan rule around the city, which proves the importance of the city during different era.

Repeatedly the city testifies its importance in history during the 7th to 11th centuries. Many empires have built temples in this city dedicated to various deities of the Hindu gods. Later in 1936, Cuttack became Odisha's capital. However in 1947 due to vulnerability to flood; Cuttack no longer remained the capital of the state, instead Bhubaneswar gained the title and remains .

BHUBANESWAR SMART CITY

Government of Odisha vide Notification No. 4741 dated 23/02/2016 constituted a Special Purpose Vehicle (SPV) company named "Bhubaneswar Smart City Limited" for implementation of Smart City Proposal of Bhubaneswar selected under Smart City Mission programme.

Bhubaneswar Smart City Limited (BSCL) is the nodal agency to plan, implement, manage and operate the Smart City Development Projects in the city. In accordance with the mission guidelines, the implementation will be undertaken in the area falling under jurisdiction of Bhubaneswar Municipal Corporation

Objective

- To promote Bhubaneswar as a livable city that gives a better quality of life to its citizens with a clean and sustainable environment.
- To enter into contracts, partnerships and service delivery arrangements with Indian as well as foreign firms, as may be required for the implementation of the Smart Cities Mission.
- To undertake comprehensive development by promoting mixed land use, provision of housing for all, the creation of walkable localities, preserving and developing open spaces, promoting a variety of transport options including transit-oriented development, public transport & last mile para-transport connectivity, making governance, citizen friendly and cost effective, giving identity to the city and

applying smart solutions to infrastructure and services in order to make them better.

- To undertake comprehensive development by promoting mixed land use, provision of housing for all, the creation of walkable localities, preserving and developing open spaces, promoting a variety of transport options including transit-oriented development, public transport & last mile para-transport connectivity, making governance, citizen friendly and cost effective, giving identity to the city and applying smart solutions to infrastructure and services in order to make them better.

Responsibilities

- Approve and sanction the projects involving the smart city including their technical appraisals.
- Execute the proposal for the Smart City without any intrusion on complete freedom of operation.
- Mobilize resources within timelines and take measures necessary for mobilization of resources.
- Approve and act upon the reports of a third party Review and Monitoring Agency
- Look into the progress of capacity building activities taking place.
- Develop and benefit from interlinkages of academic institutions and organizations.
- Ensure timely completion of projects according to set timelines to make sure the implementation of project start as per the date.
- Monitor and review quality control related matters and act upon issues arising thereof.

- Take measures to comply with the requirements of the MoUD /other Ministries/Departments of the Government of India Central/State Government Rules and regulations, local laws etc. for implementation.
- Undertake review of Mission budget, implementation of projects, preparation of Smart City Proposal (SCP) and ensuring co-ordination with other parallel missions/schemes
- Incorporation of joint ventures and subsidiaries and enter into Public Private Partnerships including with foreign entities as may be required for the implementation of the Smart Cities Mission.
- Forming Joint ventures, subsidiaries and incorporating PPP with foreign entities, as and when required for Smart city Mission implementation.
- Undertaking any and all functions as delegated by the Central and state government as well as the ULBs that fall within the scope of Smart City Mission.
- Determination of user charges applicable and collecting the same as authorized by the ULB.
- Undertaking collection of taxes, surcharges and other payables as applicable and authorized by the ULB.

CHAPTER II

GIS

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GIS

GIS and Frameworks of Smart City:-

GIS

A Geographic Information System (GIS) is a computer system for capturing, storing, checking, and displaying data related to positions on Earth's surface. By relating seemingly unrelated data, GIS can help individuals and organizations better understand spatial patterns and relationships.

GIS technology is a crucial part of spatial data infrastructure, which the White House defines as "the technology, policies, standards, human resources, and related activities necessary to acquire, process, distribute, use, maintain, and preserve spatial data."

GIS can use any information that includes location. The location can be expressed in many different ways, such as latitude and longitude, address, or ZIP code.

Many different types of information can be compared and contrasted using GIS. The system can include data about people, such as population, income, or education level. It can include information about the landscape, such as the location of streams, different kinds of vegetation, and different kinds of soil. It can include information about the sites of factories, farms, and schools, or storm drains, roads, and electric power lines.

With GIS technology, people can compare the locations of different things in order to discover how they relate to each other. For example, using GIS, a single map could include sites that produce pollution, such as factories, and

sites that are sensitive to pollution, such as wetlands and rivers. Such a map would help people determine where water supplies are most at risk.

Data Capture:-

Data Formats

GIS applications include both hardware and software systems. These applications may include cartographic data, photographic data, digital data, or data in spreadsheets.

Cartographic data are already in map form, and may include such information as the location of rivers, roads, hills, and valleys. Cartographic data may also include survey data and mapping information that can be directly entered into a GIS. Photographic interpretation is a major part of GIS. Photo interpretation involves analyzing aerial photographs and assessing the features that appear. Digital data can also be entered into GIS. An example of this kind of information is computer data collected by satellites that show land use—the location of farms, towns, and forests.

Remote sensing provides another tool that can be integrated into a GIS. Remote sensing includes imagery and other data collected from satellites, balloons, and drones.

Finally, GIS can also include data in table or spreadsheet form, such as population demographics. Demographics can range from age, income, and ethnicity to recent purchases and internet browsing preferences.

GIS technology allows all these different types of information, no matter their source or original format, to be overlaid on top of one another on a single map. GIS uses location as the key index variable to relate these seemingly unrelated data.

Putting information into GIS is called data capture. Data that are already in digital form, such as most tables and images taken by satellites, can simply be uploaded

into GIS. Maps, however, must first be scanned, or converted to digital format. The two major types of GIS file formats are raster and vector. Raster formats are grids of cells or pixels. Raster formats are useful for storing GIS data that vary, such as elevation or satellite imagery. Vector formats are polygons that use points (called nodes) and lines. Vector formats are useful for storing GIS data with firm borders, such as school districts or streets.

FIG.1: GIS Data Formate

2.1.3 GIS Maping

Once all the desired data have been entered into a GIS system, they can be combined to produce a wide variety of individual maps, depending on which data layers are included. One of the most common uses of GIS technology involves comparing natural features with human activity.

For instance, GIS maps can display what man-made features are near certain natural features, such as which homes and businesses are in areas prone to flooding.

GIS technology also allows users to “dig deep” in a specific area with many kinds of information. Maps of a single city or neighborhood can relate such information as average income, book sales, or voting patterns. Any GIS data layer can be added or subtracted to the same map.

GIS maps can be used to show information about numbers and density. For example, GIS can show how many doctors there are in a neighborhood compared with the area’s population.

With GIS technology, researchers can also look at change over time. They can use satellite data to study topics such as the advance and retreat of ice cover in polar regions, and how that coverage has changed through time. A police precinct might study changes in crime data to help determine where to assign officers.

One important use of time-based GIS technology involves creating time-lapse photography that shows processes occurring over large areas and long periods of time. For example, data showing the movement of fluid in ocean or air currents help scientists better understand how moisture and heat energy move around the globe.

GIS technology sometimes allows users to access further information about specific areas on a map. A person can point to a spot on a digital map to find other information stored in the GIS about that location. For example, a user might click on a school to find how many students are enrolled, how many students there are per teacher, or what sports facilities the school has.

GIS systems are often used to produce three-dimensional images. This is useful, for example, to geologists studying earthquake faults.

GIS technology makes updating maps much easier than updating maps created manually. Updated data can simply be added to the existing GIS program. A new map can then be printed or displayed on screen. This skips the traditional process of drawing a map, which can be time-consuming and expensive.

GIS Used for Smart City Planning

The applications of GIS in smart city planning are countless. The city always has a dense population & more infrastructure but the IGiS tools help the planners to understand the needs of such a city. Also, the planners can adapt to examining smaller towns and slum or informal settlements. IGiS has the capability of performing a variety of queries hence experts can analyze how new planning activities will fit in with the current/ infrastructure and meet regulatory demands.

IGiS offers powerful mapping and advanced visualization tools which are enabling planners to create 3D view of city. The environmental and socioeconomic data can be used to create maps & can perform tasks like:

- Land Acquisition & New Area Development Planning
- Slum Rehabilitation Development Planning
- Development Planning (Residential, Commercial, Industrial, Park, Garden, Health, Education, Vehicle Parking)
- Utility Development Planning (Water, Sewerage, Solid waste, Road, Footpath, Streetlight)

Property Tax Analysis using GIS

A GIS platform for Smart City is used to act as the backbone of the geospatial database. IGiS acts as a single platform for handling property information. All properties are geo-enabled. Through the Property Tax

Analysis module in IGiS, officials can easily identify the tax defaulters and in the long run government can have exponential growth in revenue. IGiS enables stakeholders to derive information about the property like age of property, type of property (residential, commercial), unpaid taxes, properties converted from residential to commercial & so on. Primary features of the IGiS Property Tax Analysis Module are:

- GIS Based Property Tax Analysis Dashboard
- Integration with Property Tax Management Information System (MIS) Application
- Image Processing based New Property Identification
- Property Tax Defaulter Analysis
- Geo Enabled (location enabled) Support to Revenue Inspector

Encroachment Analysis using GIS

GIS provides the optimum solution for Encroachment Analysis. Predominantly GIS can identify encroachment activities like:

- Government Plot Encroachment Analysis & Residential Property Analysis
- Non Compliance with Land Use Encroachment Analysis
- Water Body Encroachment Analysis & Green Coverage Analysis
- Green Cover Encroachment & Illegal Parking Encroachment Analysis
- Geo-tagged Accountability work flow
- Identify the unauthorized Construction Information

Health Service Analysis using GIS

The location-based services play a remarkable role to reach the destination of unknown places by using geospatial technology. It will help to access the healthcare facilities (hospitals/clinics, medical stores, rural /primary health centres, and many others). A true example and realized by everyone, IGiS played a significant role to develop the maps regarding pandemic (COVID-19) emergency.

Road and Traffic Network Analysis using GIS

The smart technology adoption for transportation systems is now available everywhere with automated signaling, live status of vehicle, live location tracking platform, and many others. Alternative or cost-effective routes can be analysed in case of traffics, emergencies or certain festivals and etc.

Water Supply Network using GIS

GIS technology is used to view information related to water supply:

- Mains, Distribution Line, Wells, Over Head Tanks, Water Supply Pipeline, Waste Water Supply.
- Public Taps, Storage, Street Taps, Ground Level Dump Reservoir, Direction of Flow, Meters, Consumer.

In addition to this, the water source of the city can be easily identified from different water bodies such as lakes, open wells, bore wells, etc. The shortest route from the particular pumping station to the different distribution networks of water pipelines can be assessed. Using GIS one can plan and track the maintenance schedule of water supply pipes.

Sewerages Network Analysis using GIS

Similar to water supply network analysis, GIS technology is used to plan and track the maintenance schedule of sewerage lines. It is also used to identify the information spatially by query analysis based on many factors (diameter of the pipeline, material of construction, flow capacity, depth of the pipeline). Also, details such as status of pumping mains, current capacity of sewers, dumping sites, transfer stations and waste handling facilities can be digitally ascertained.

The Sewer Network Analysis module graphically displays information on:

- Septic Tanks, House Hold Connection, Pits, Manholes, Open Drainage
- Derivation line of underground pipes using manhole and well locations
- Connectivity of House Hold Network, Flow Direction to be taken up to STP
- Disposal Sites

Solid Waste Analysis using GIS

Using GIS technology, we can optimize the route for the waste collection process. It enhances the collection efficiency & officials can track the waste collection process and transportation vehicles. Additionally, we can use the GIS technology for future resource requirements like vehicles & human resources for planning and monitoring of solid waste. In the IGiS Solid Waste Analysis module, officers can plan Dustbin Locations, Garbage Collection, etc.

Disaster & Emergency Services Management using GIS

The incredible potential of GIS to benefit the Disaster & Emergency Services Management can be experienced when used. GIS mainly involves the future-based disaster management & mitigation process. Disaster-based complete

digital database (Pre-Disaster & post- Disaster) is mapped & displayed to the public to gain awareness about the severity of disasters. Additionally, needy emergency details (where & when) are also mapped. It leads to a safe & secure life for the citizens. From this, city officials can make a plan to mitigate the disaster such as vulnerability site analysis, shortest path, road closures & etc.

The significant GIS applications are listed below in Disaster & Emergency Services Management.

- Identify Disaster Location
- Buffer Affecting Area
- Pull Property Details Mobile No or Mobile tower connected phones
- SMS to disseminate Information on disaster information and remedy or Standard Operating Procedure (SOP) for disaste
- Activate Response SOP

Estate Management using GIS

GIS has the ability to digitally view municipal plot details along with plot dimensions, leading to quick access to information for all. It helps in the proper management of land by highlighting the significant features of a property. In addition, it gives information about slums and the location of ULB (Urban Local Bodies) owned vacant lands & and encroachment, ward boundaries, and so on.

Remote Sensing

Remote sensing is the acquiring of information from a distance. NASA observes Earth and other planetary bodies via remote sensors on satellites and aircraft that detect and record reflected or emitted energy. Remote sensors, which provide a global perspective and a wealth of data about Earth

systems, enable data-informed decision making based on the current and future state of our planet.

Orbits

Observing with the Electromagnetic Spectrum

Resolution

Data Processing, Interpretation, and Analysis

Data Pathfinders

Types of Remote Sensing

There are two types of remote sensing instruments—passive and active. Passive instruments detect natural energy that is reflected or emitted from the observed scene. Passive instruments sense only radiation emitted by the object being viewed or reflected by the object from a source other than the instrument.

ACTIVE & PASSIVE REMOTE SENSING

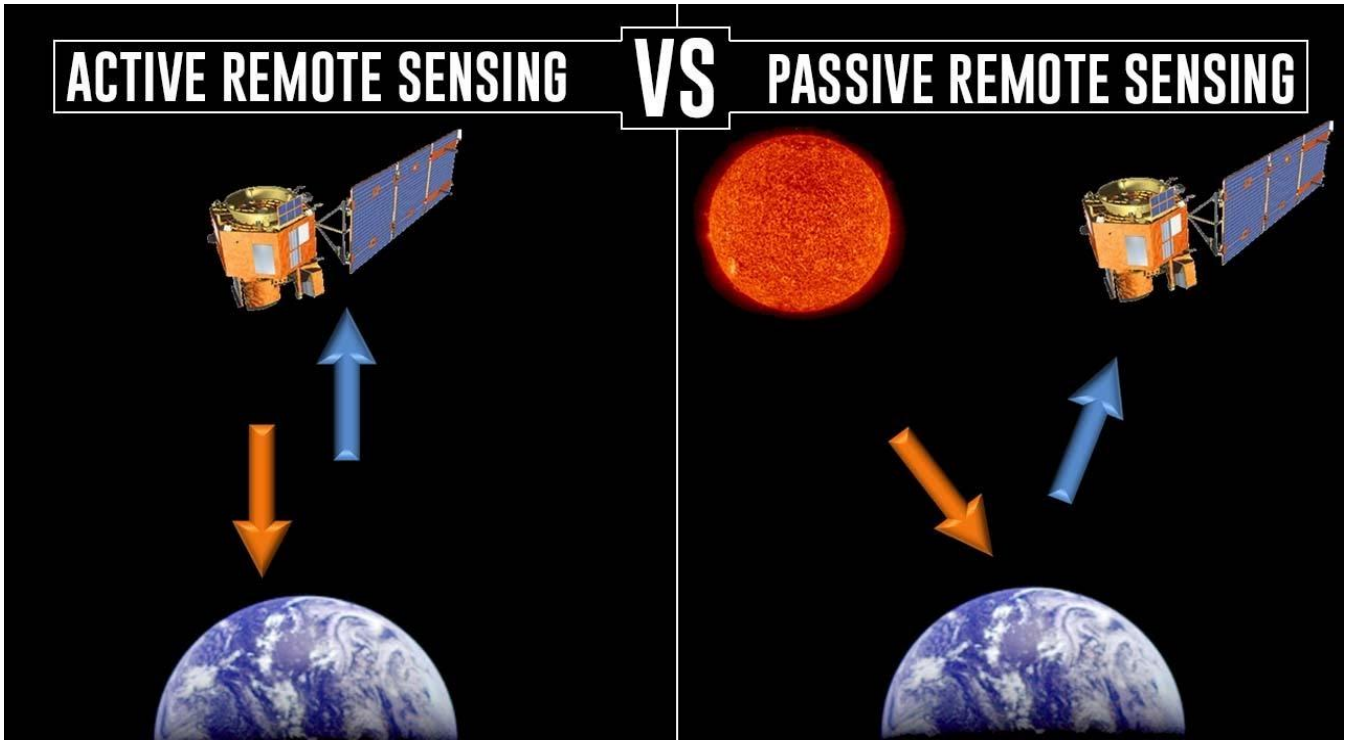

FIG.2 – Types of Remote Sensing

Methodology:-

1.8.1Feature extraction by Google earth

Take the imaginary data from the Google earth of our study area and extract the features such as roads, buildings, service centres others feature to identify. Object based image analysis combines spectral information and spatial information. Now a days Google earth is developed by keyhole as an earth viewer. In Google earth we can extract the points, lines and polygon features. We can the point features by making mark on it and we can identify the feature to extract. To extract the polygon create the polygon on the buildings.

3.4.2 Field work

After extraction of feature by using Google on extensive field survey is to be done to collect the elevation of te buildings and to find the service centres near by the study area. By collecting the elevation data we can easily develop the building in ArcGIS. Field work is to be done to find the public buildings, gardens, drainages etc., we can easily identify the features by doing the field survey. Field work is the collection of raw data or gathering the information about something in real.

Depth simulation

Import the elevation from the Google earth pro into the arcGIS and create Digital Elevation Model for that one. Import the file into the arc Scene then create TIN. Provide z values for the area in TCX converter. Go to annimation in arc Scene and create the depth simulation for the area. It shows the area where the elevation is low and firstly affected due to floods. We can change the level of flood and see the submergence of houses in smart city. We located the area where floods are causing more damage to the public.

Role of City Engine

City Engine is a tool developed by the ESRI. CityEngine is used to generate simple extrusion on the imported footprints. The extrude cga rule file uses the height object attribute to extrude the footprint to the defined height. During import CityEngine prompts you to choose a scene coordinate system. The coordinate system suggested in dialog box is taken from the data found in geodata base. The data set in the provided geodata base is identical to the shape file content. You can now apply the shape file steps described above to your file geodata base import. The data in the shape files is in meters and it is not georeferenced, so choose the raw data in meters use the specific syntax in the GIS application to define which rule files and start rules are assigned directly after import. This is a special import behaviour.

Import buildings

Import the footprints of the buildings and assign the rule file to generate the models. It is easier to model volumes in an external application than to describe them with the CGA grammer. A crude building volume is modelled and imported in to the City Engine and its facades can be refined using CGA rule. The building volume, name already defined its start rule Building. Consequently we need to have Building as the starting rule. We need to the align the coordination system of the imported model to City Engine yup system. This is done with the CGA command. After that we can identify the different faces of the imported building. We use the top selector for the root faces and side selector for the side faces.

Road Extraction

By using CityEngine tool you can develop the multi-storeyed parking and different types of parking system. You can design them by using cga rule file and the CityEngine can generate the models according to the rule file.

Bridge

Make the connection for two areas on river by designing the bridge on it. Select the proper area to lay the bridge using CityEngine. In CityEngine there is lot of bridge models. Choose appropriate model to make the connection. Give the cga rule file in CityEngine software. If you want to make some more changes for bridge such as height, width, type of road, kerbs and its dimensions, lighting system, traffic signals, traffic signs and most important thing is architecture. Using different start rules in CityEngine change the architecture.

Mapping, buffer zone

Locate the facilities in city is one of the part of smart city planning and also give safe and shortest distance to it. Make the buffer zone around the smart area with 2 km radius for knowing facilities. Using Google earth pro software it was done and make it easy to point out the needs in this buffer zone. Locate the required and most prominent places in the buffer zone. In this zone we can provide the facilities for human needs such as e-services, health, education, employment, hotels etc,. Knowing these centres it is easy to overcome any problem in the city.

GIS Network analysis

Network analysis is a tool used in the GIS software. The network analysis tool is used to find the road network of a map. By using spatial manager you can split the roads and you can find the best route for the places. By using network analysis you can find best and shortest routes to the places. In GIS you give the paths between two points and network analysis will shows you the best and shortest route. And also you can create the new routes from one place to another.

Methodology Flow Chart

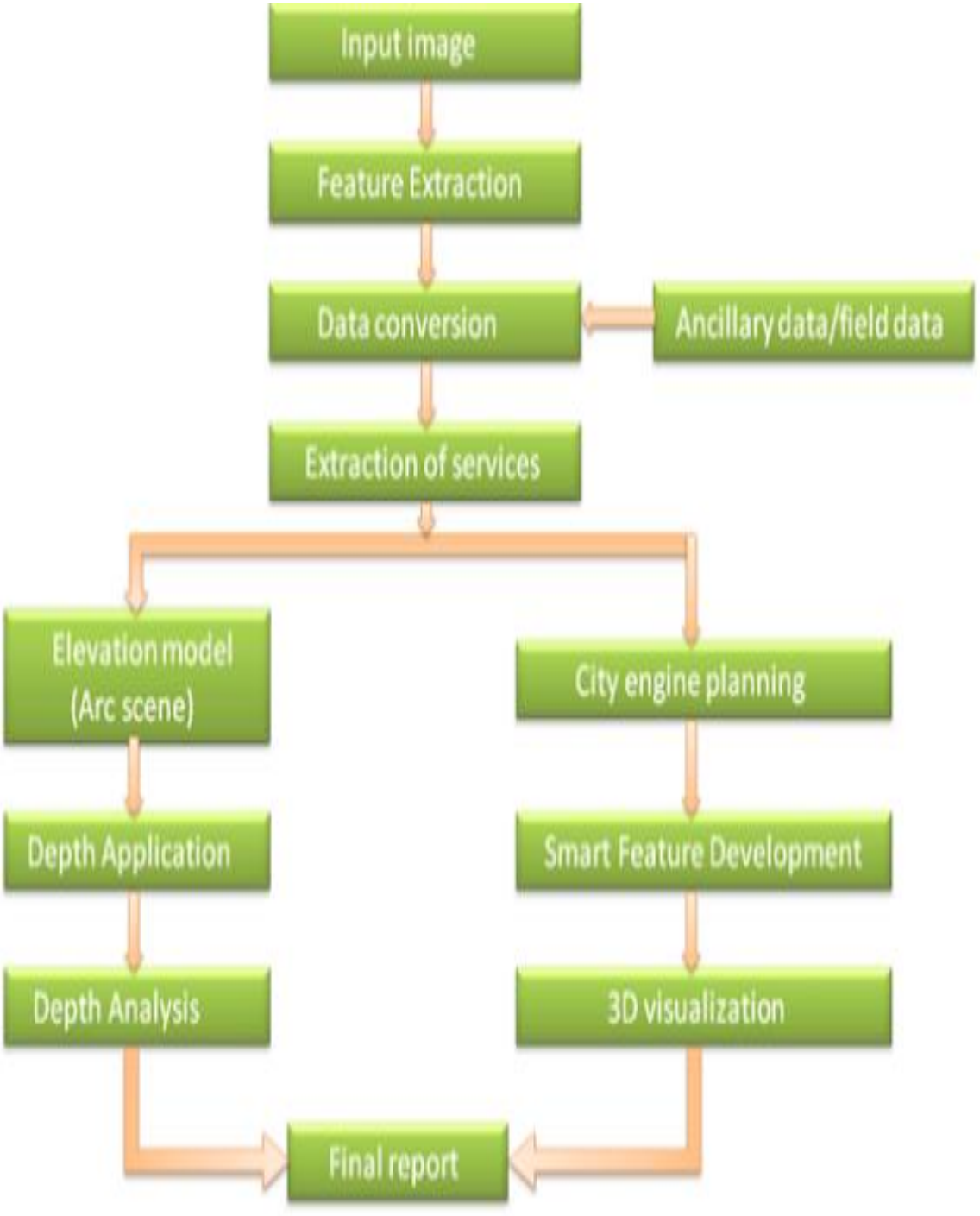

FIG.3 Methodology Flow Chart

CHAPTER III

REVIEW OF LITERATURE

CHAPTER III

REVIEW OF LITERATURE

Interdisciplinary urban GIS for smart cities (Dec 2012) : As urbanization process has been and will be happening in an unprecedented scale worldwide, strong requirements from academic research and practical fields for smart management and intelligent planning of cities are pressing to handle increasing demands of infrastructure and potential risks of inhabitants' agglomeration in disaster management. Geospatial data and geographic information systems (GISs) are essential components for building smart cities in a basic way that maps the physical world into virtual environment as a referencing framework. On higher level, GIS has been becoming very important in smart cities on different sectors. In the digital city era, digital maps and geospatial databases have long been integrated in workflows in land management, urban planning and transportation in government. People have anticipated GIS to be more powerful not only as an archival and data management tool but also as spatial models for supporting decision-making in intelligent cities. Successful applications have been developed in private and public organizations by using GIS as a platform for data integration, a system for geospatial analysis and collection of models for visualization and decision-making. Location-based services on smart mobile devices in ubiquitous telecommunication networks are now an indispensable function that expands knowledge of the nature and connections among people. On data side, crowd-sourcing, real-time urban sensing and true 3-dimensional (3D) models and

visualization have provided more advantages of GIS to final users and at the same time challenged current available solutions and technologies of data handling, visualization and human–computer interaction. On the technological side, Web 2.0 participatory applications provide the framework and environment for GIS to closer link to photogrammetry and computer vision, which empowers smart devices more capabilities. How to manage big geo-tagged data volumes collected by numerous sensors and implement professional GIS functions in a cloud computing environment are urgent questions to facilitate smart cities management. This paper reviews advancements of GIS in the management of cities as information systems to facilitate urban modelling and decision-making, as referencing basis to integrate social network media, and concludes that an interdisciplinary urban GIS is needed to support development of smart cities. We take Singapore as a case of GIS pervasive applications, which has strategically made a master plan of national information infrastructure and has been implementing geospatial collaboration environments for public and private sectors.

Information technology as a tool for public participation in urban planning: a review of experiments and potentials (May 2007) : Information technology offers new potentials of citizen participation in urban planning. The essential tasks to achieve with the use of new media are: providing a communication platform which suppresses a barrier of non-professionalism, allowing for distant contacts and enabling participatory process management. The paper contains a review of experiments and prototypes of different IT applications: Participatory Planning GIS, 3D models, communication platforms and computer games. Technology facilitates also collaborative distant work and citizens' participation in the city database

completion. The most cited examples remain experimental. Great potential lies in augmented reality technology, which is currently being tested.

Scenario simulation studies of urban development using remote sensing and GIS (April 2021) : In the past two decades, urbanization has been accelerating worldwide. The rapid increase in population has negatively impacted the urban environment and the quality of life. Today, as a result of rapid economic growth and urban development, many cities suffer from numerous problems such as traffic congestion, noise, air and water pollution, etc. With such conditions worsening, various scenario simulation analyses have been conducted to predict future urbanization to aid the management of sustainable urban development. This paper examines research trends and the usefulness of urban scenario modeling by conducting an extensive survey of articles on urban land-use scenario simulations. We discuss the advantages and limitations of urban scenario analyses via a systematic and quantitative review. The focus is on global planning designs, urban planners, and politicians who should draw up suitable frameworks to implement sustainable urban development policies. We conclude that sophisticated scenario modeling could help achieve Sustainable Development Goals (SDGs).

CHAPTER IV

ANALYSIS

CHAPTER IV

ANALYSIS

DIGITIZING VARIOUS ASPECTS OF SMART CITY ELEMENT

Digitization is the most important technique of data and storage in a GIS but is expensive and time consuming. Map making has been one of the most important achievements for humankind as it was because of this humankind was able to spread throughout the globe. New lands were discovered and inhabited and in all these activities the role of maps cannot be underestimated. Thus, for ages maps have been used to portray the surface of the earth on to a paper. But while viewing the maps, one generally tends to forget that each line or point depicted on the map actually represents a considerable area on the surface of earth. Thus, if lines present on the maps are not presented accurately, it means that a large area of land becomes disputed. Now we have an age of digital revolution. Right from digital movies and digital music to digital information, the internet has played a major role in accelerating this digital revolution. Maps have become a part of this digital revolution and internet mapping is the 'in' thing now. The main issue of discussion is the ways and means of depiction of maps in digital form and the probable reasons for the occurrence of such errors in the process.

All the digitization was done using PCS (UTM Zone 45N) to extract the features present in study area like road, water body, locations, industrial setups so that we can perform various analysis upon those data for our study.

Universal Transverse Mercator (UTM)

•UTM projection is used to define horizontal, positions world-wide by dividing the surface of the Earth into 6ozones, each mapped by the Transverse Mercator projection with a central meridian in the center of the zone.

•UTM zone numbers designate 6 degree longitudinal strips extending from 80 degrees South latitude to 84 degrees North latitude.

STUDY AREA BOUNDARY

Boundary of bhubaneswar municipality corporation shown in vector format in arcmap envirnment

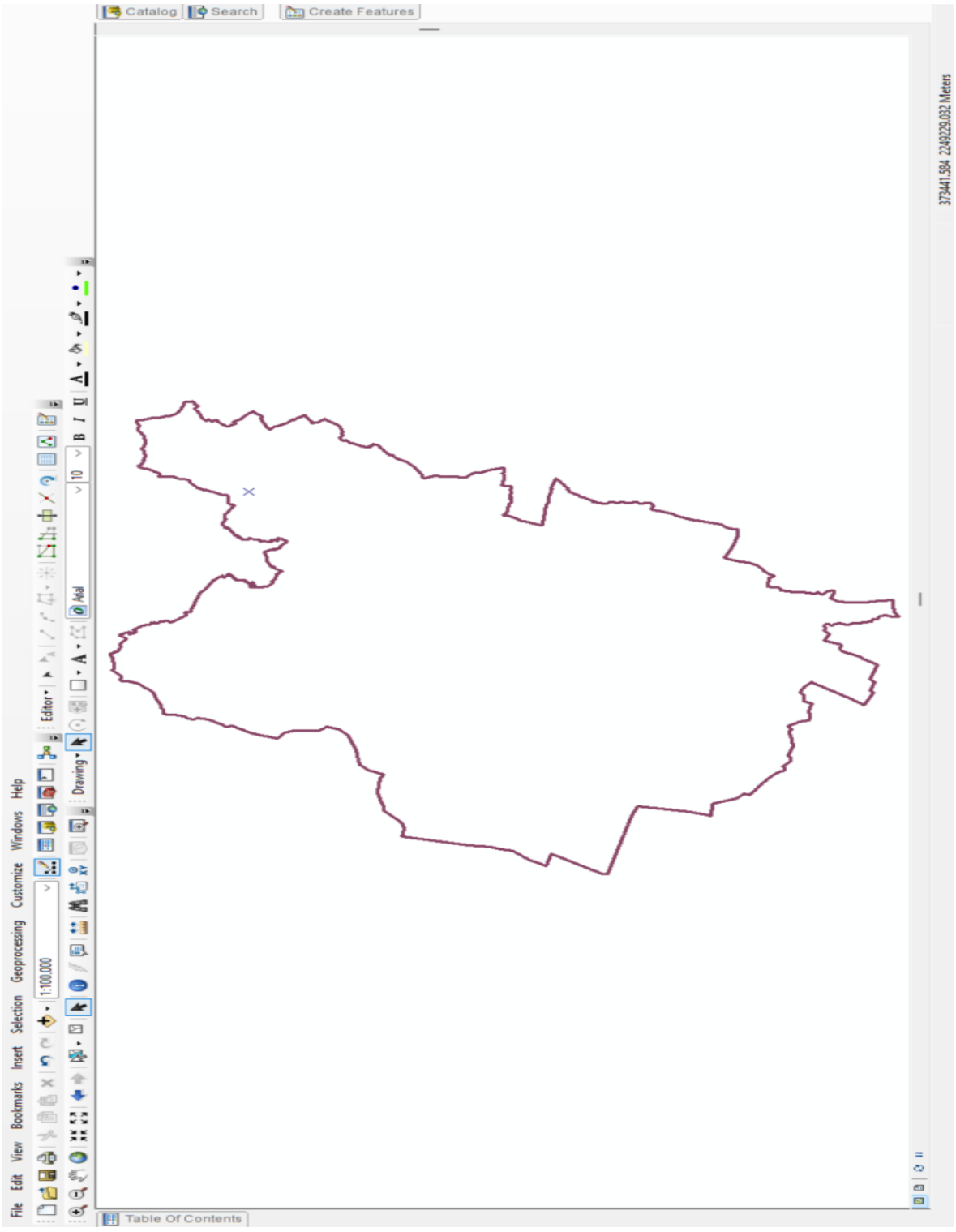

FIG.4: Study Area Boundary

SATELLITE IMAGENARY OF STUDY AREA

Satellite imaginary of study area having NCC (Natural color composite)

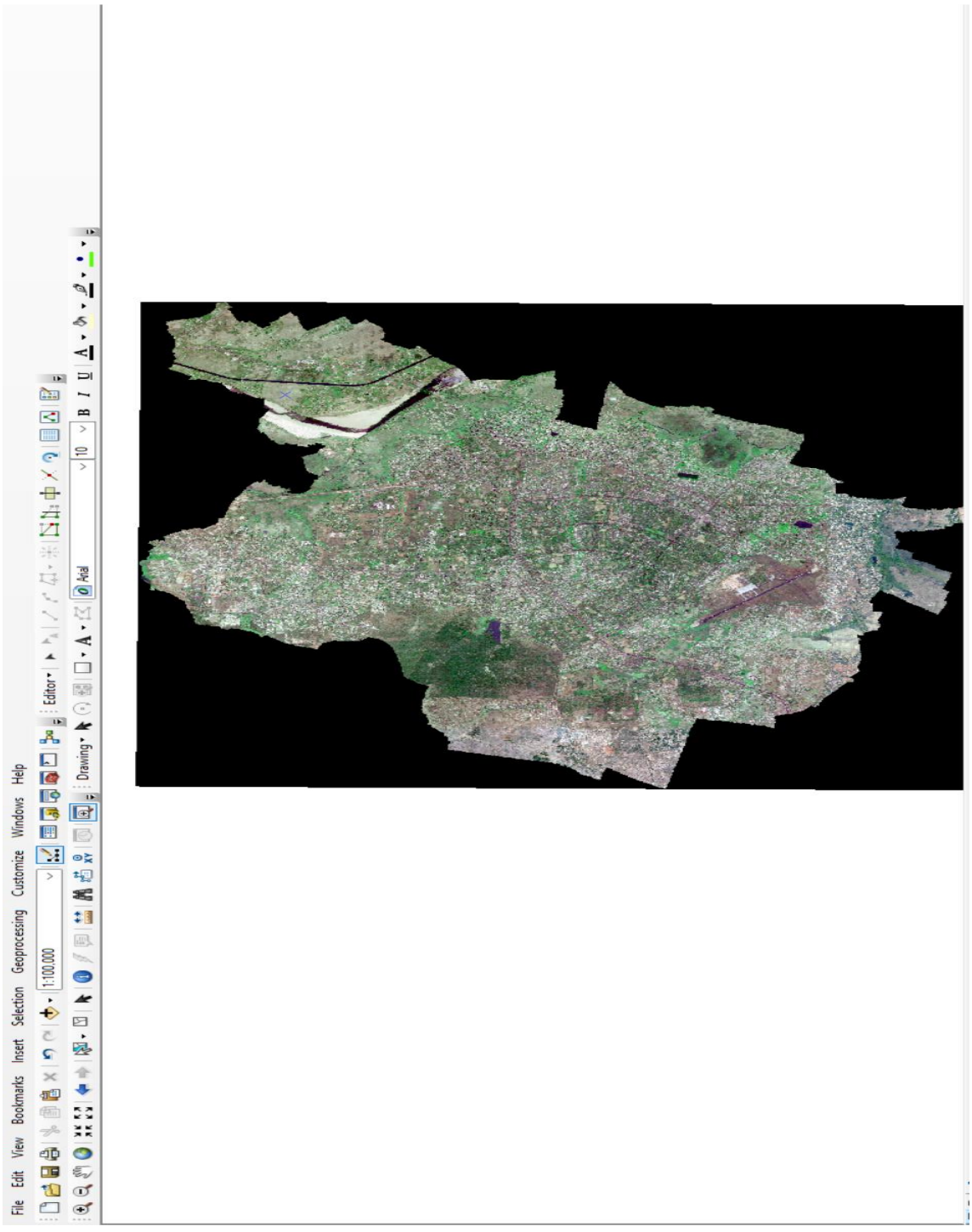

FIG.5: Satellite Imagenary Of Study Area

LANDMARKS WITHIN STUDY AREA

All the important landmarks (commonly known as chhaka) shown in vector format (point shape file) accros the study area

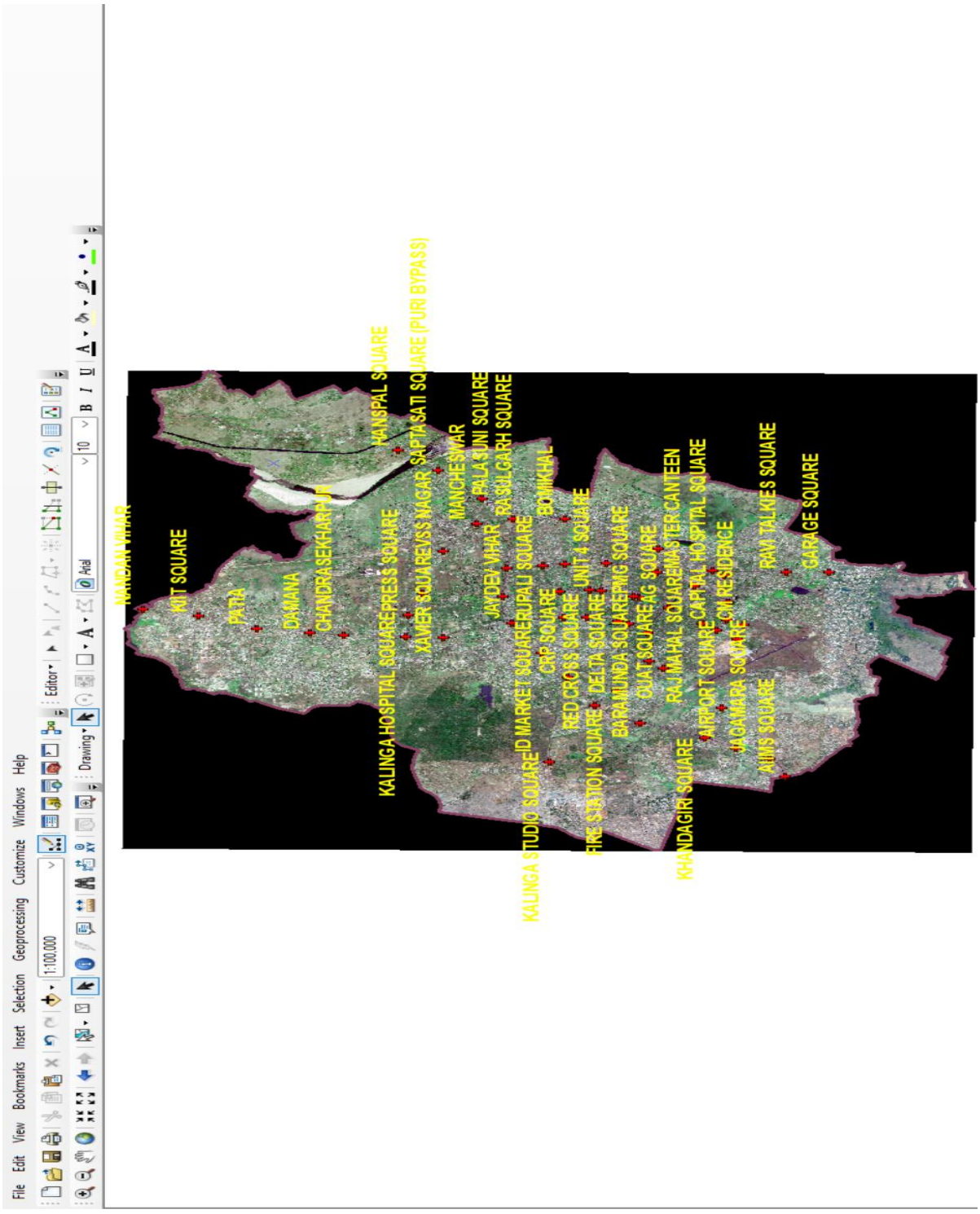

FIG.6: Landmarks Within Study Area

ROAD NETWORK ON SATELLITE IMAGE

Digitization of road network based upon the acquired satellite image using UTM as projector connect system

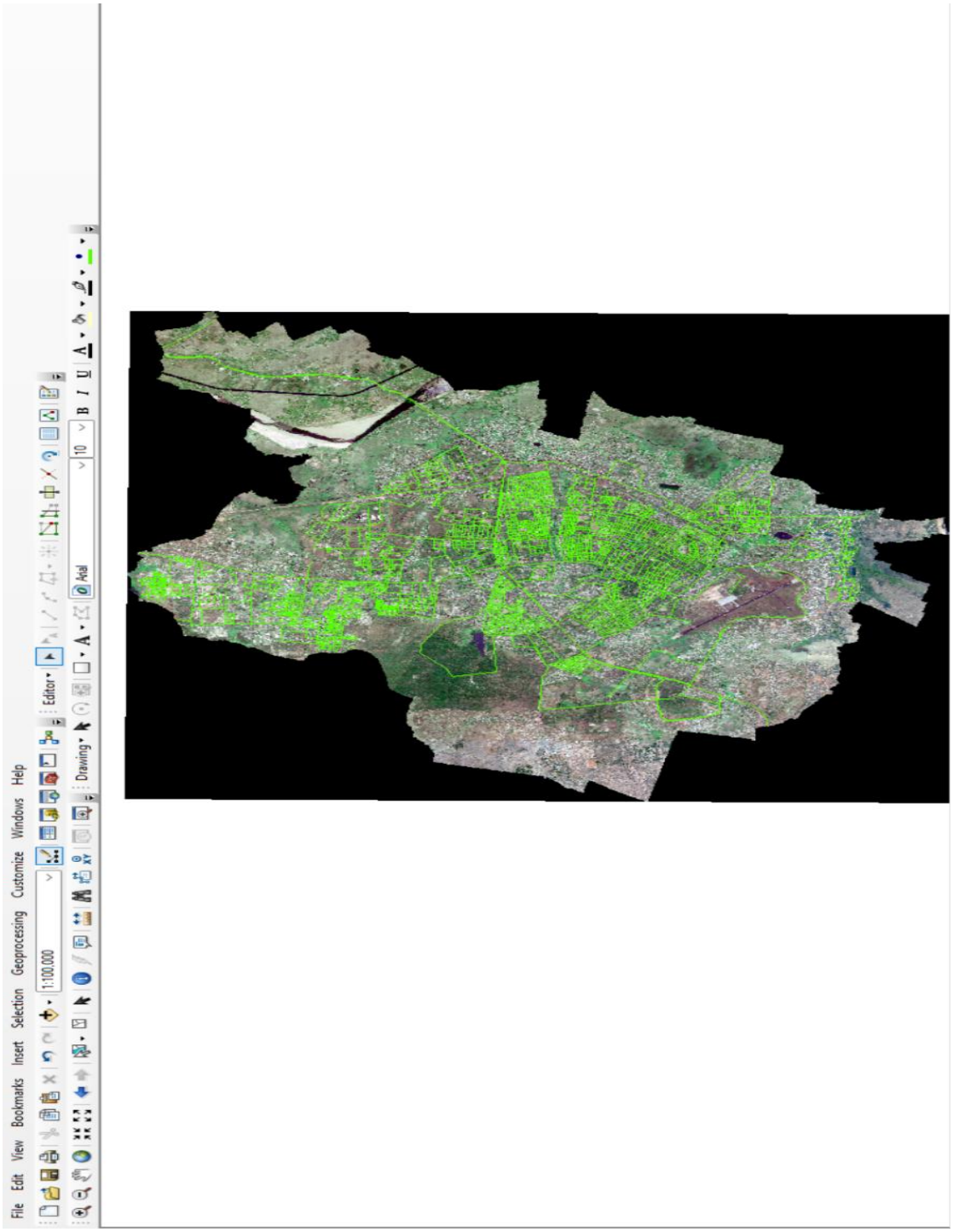

FIG.7 Road Network On Satellite Image

VECTOR REPRESENTATION OF ROAD NETWORK

Vector representation of road network extracted from satellite imagery

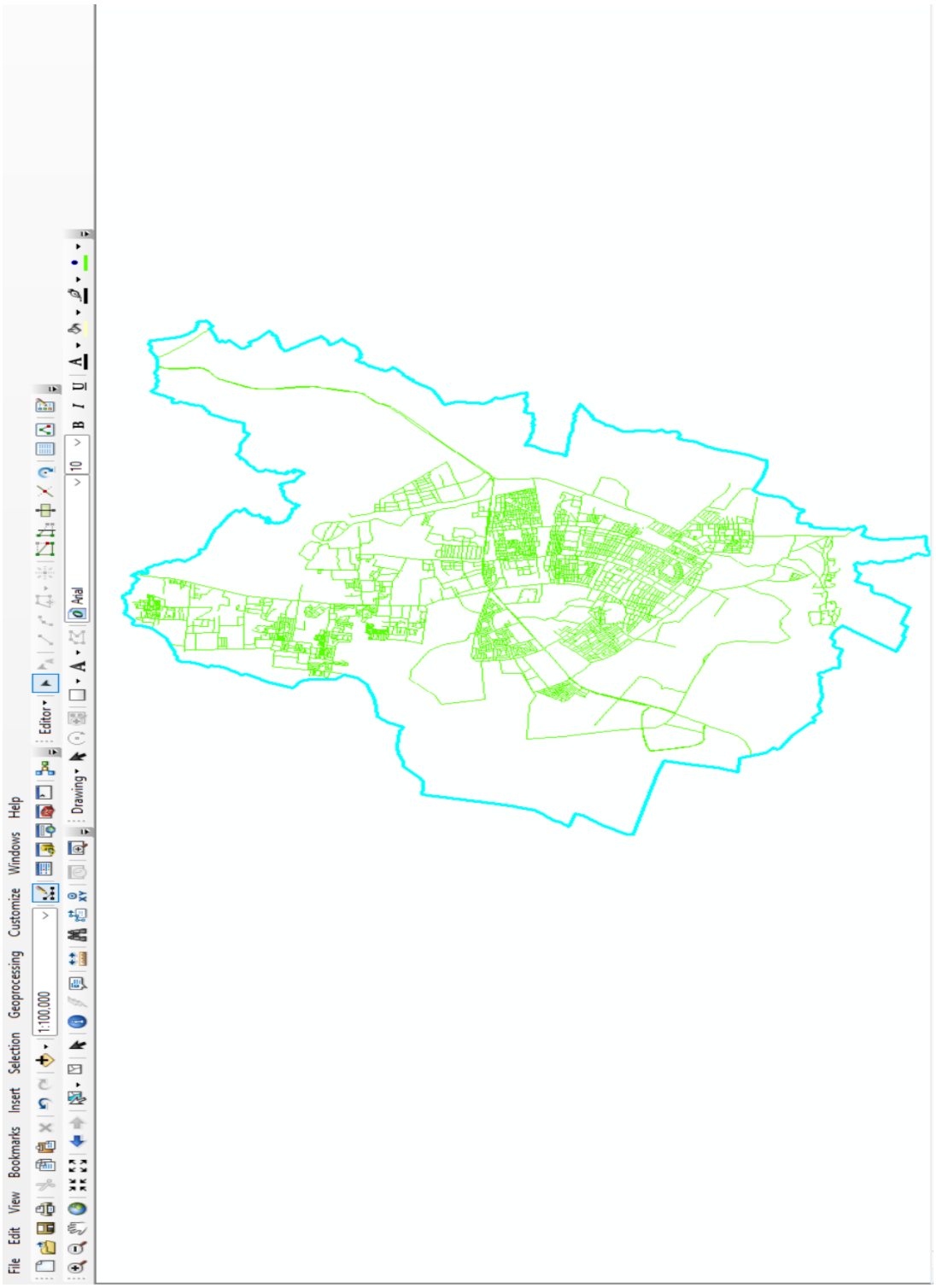

FIG.8 Vector Representation Of Road Network

RAILWAY NETWORK ON RASTER FILE

Railway network inside study area digitized with line shape file using projected coordinate system

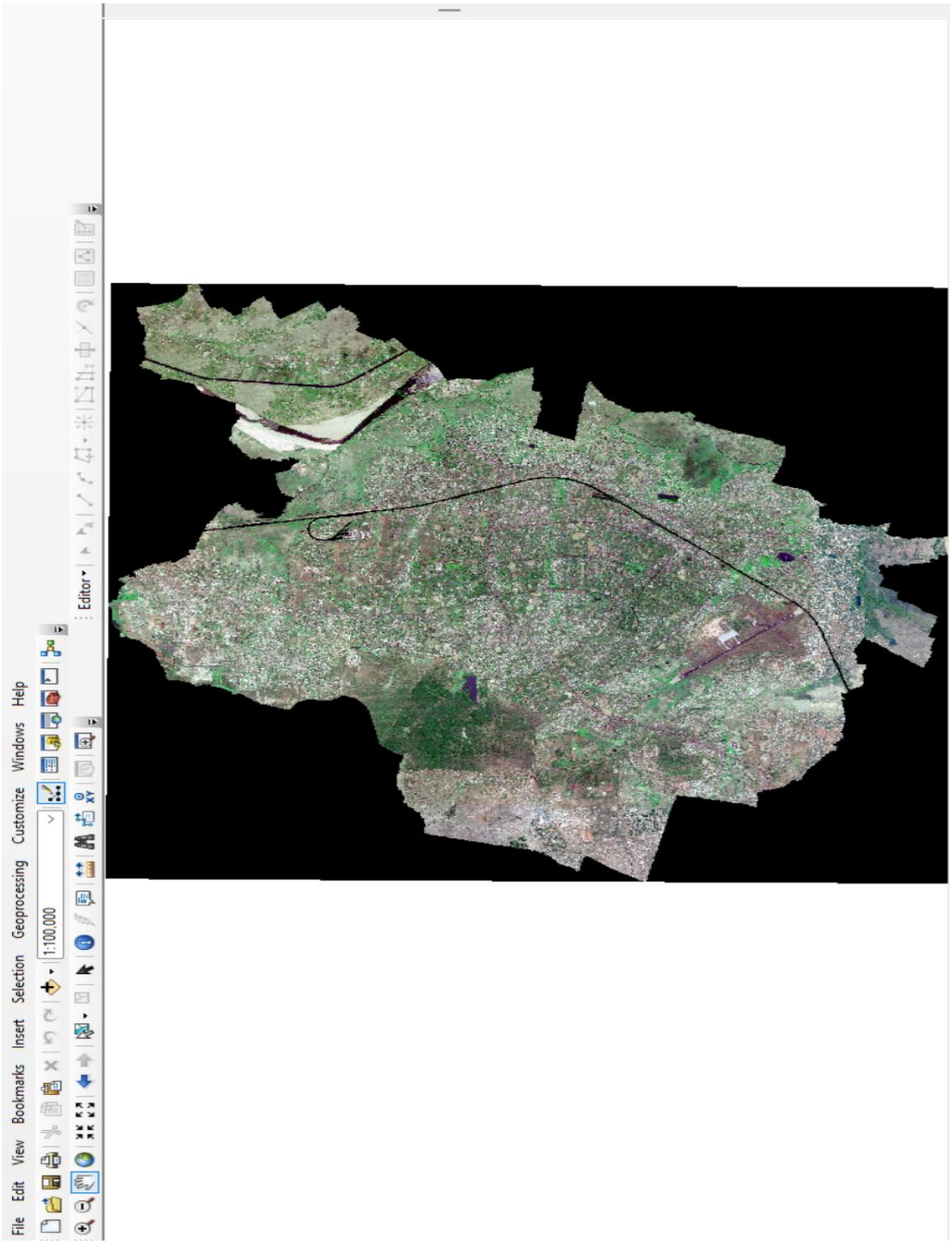

FIG.9 Railway Network On Raster File

VECTOR REPRESETATION OF RAILWAY NETWORK

Vector representation of railway network using UTM zone45North

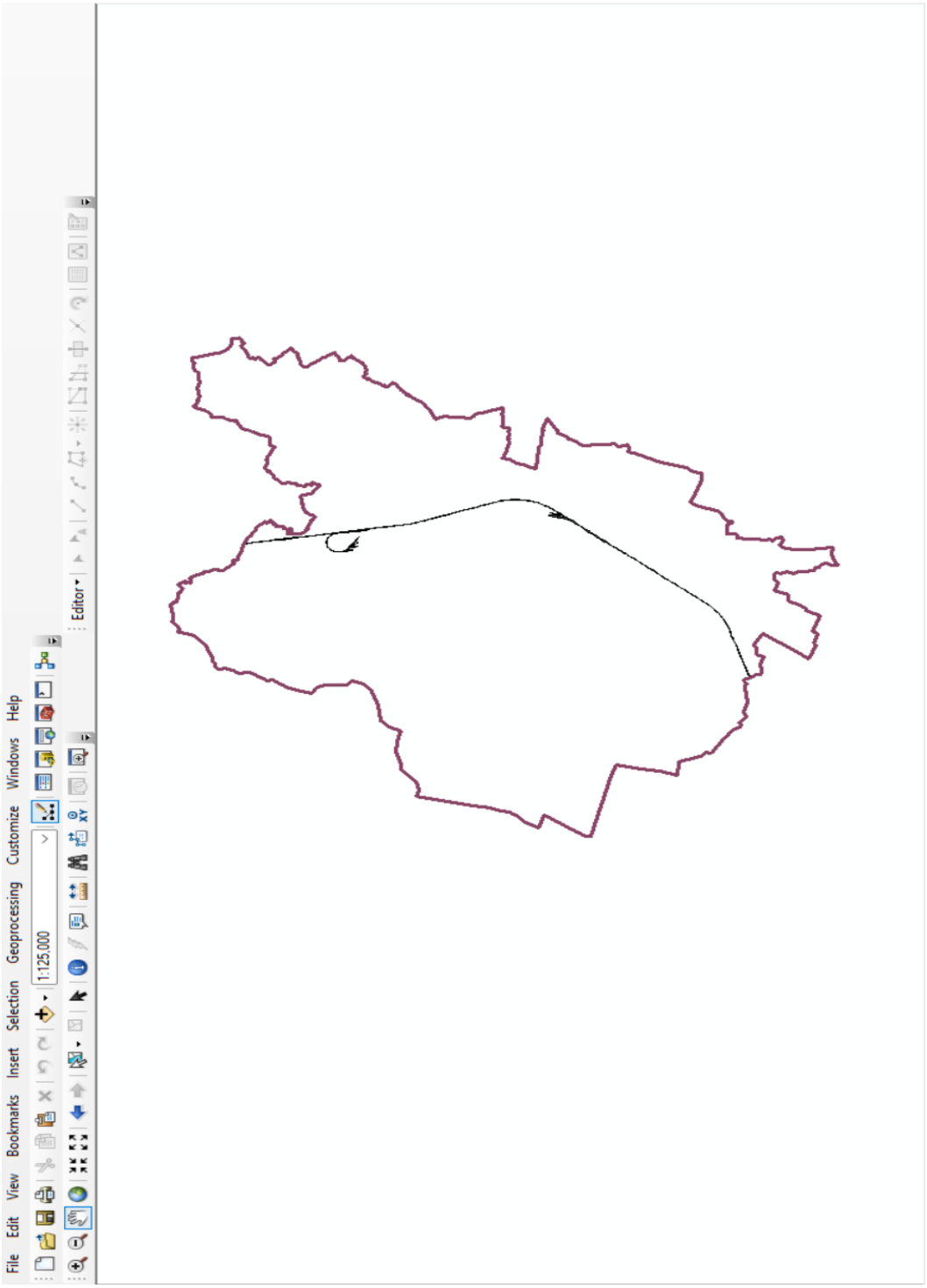

FIG.10: Vector Represetation Of Railway Network

WATER BODIES ON SATELLITE IMAGE

water bodies accross the study area is shown in blue color created in polygon shape file

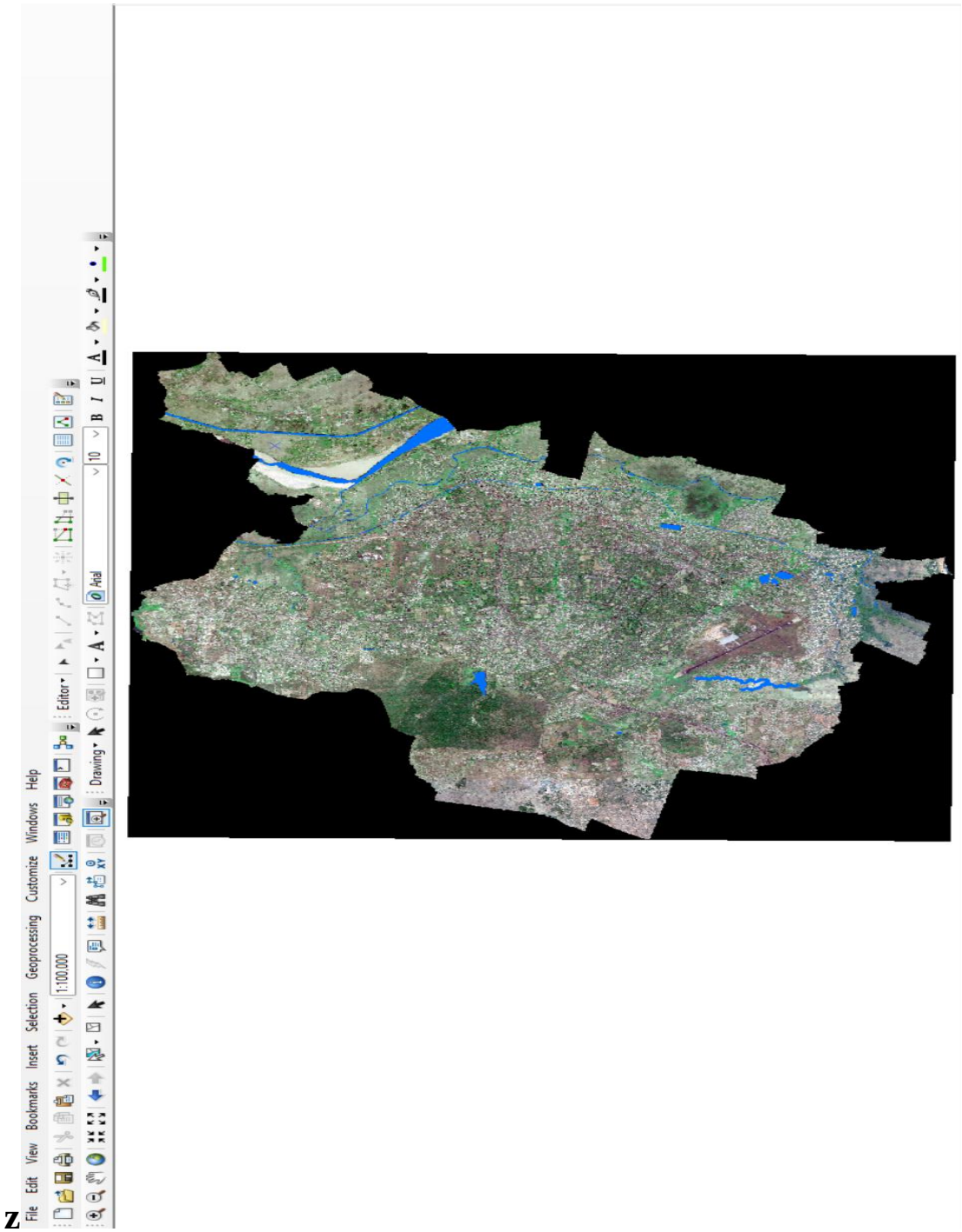

FIG.11: Water Bodies On Satellite Image

VECTOR FORMAT OF WATER BODIES

Vector format representation of water bodies within the study area

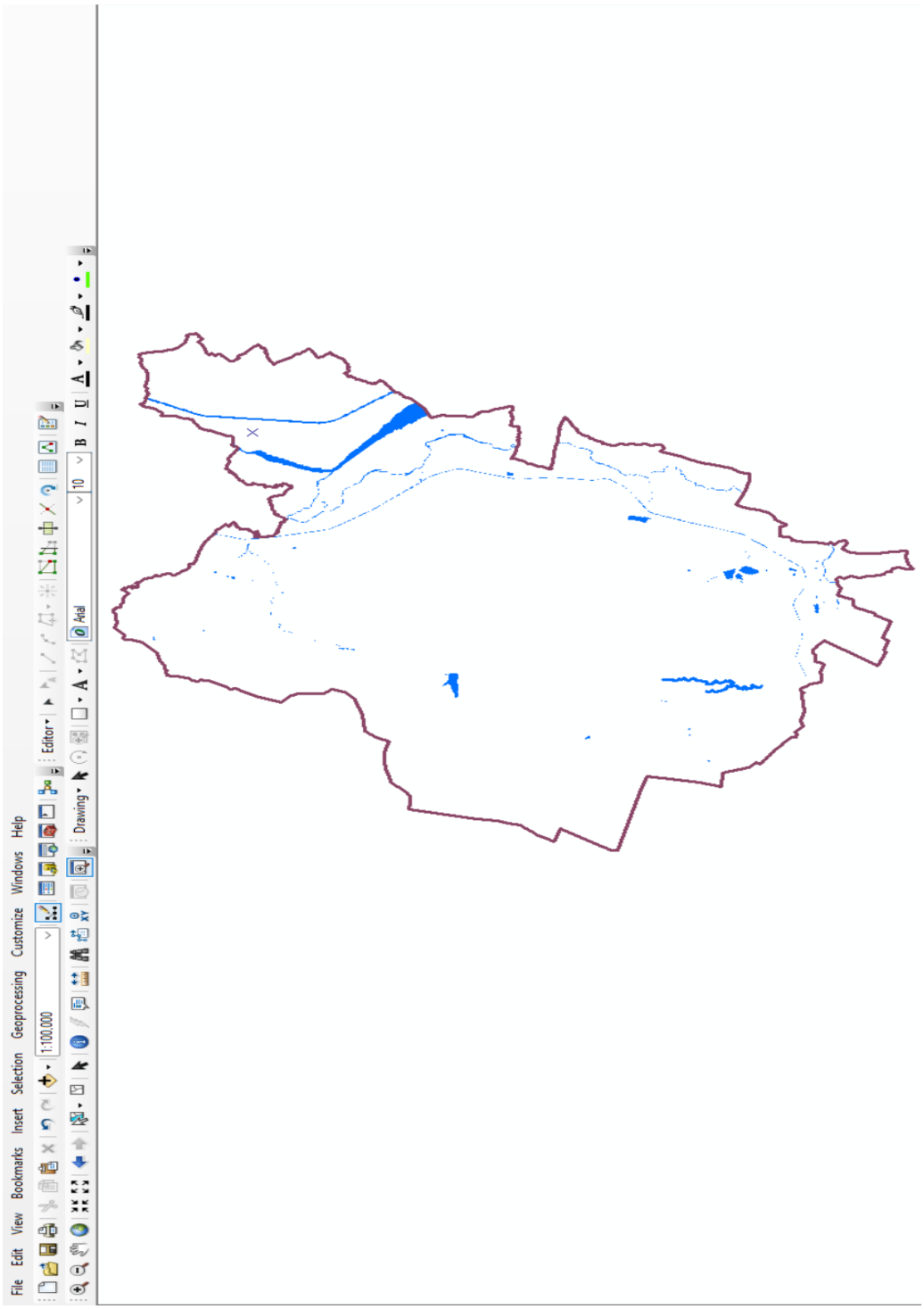

FIG.12: Vector Format Of Water Bodies

FOREST COVER ON SATELLITE

Forest cover extraction from satellite imagery using digitisation method

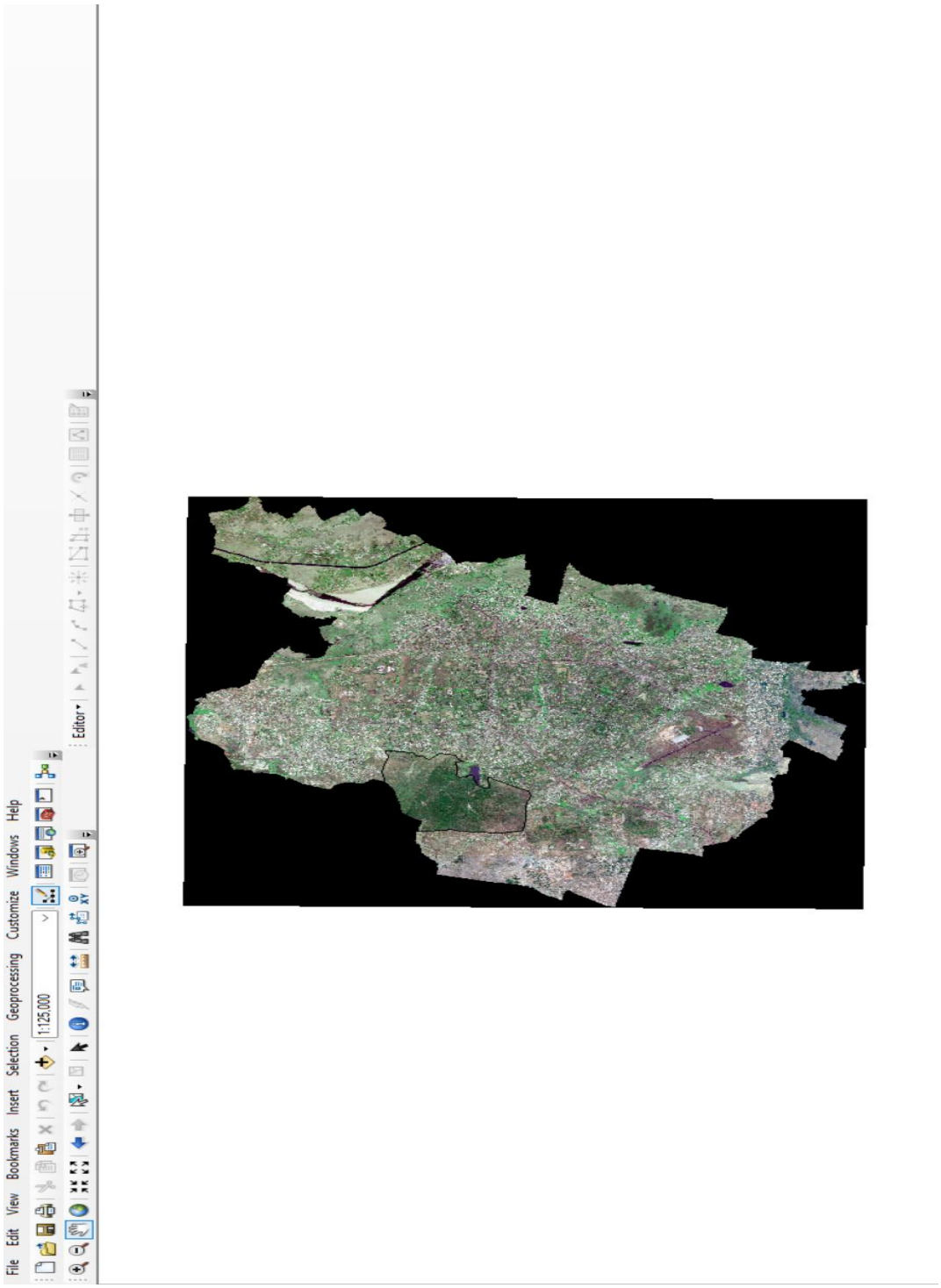

FIG.13: Forest Cover On Satellite

VECTOR FORMAT OF FOREST COVER

Vector format representation of forest cover

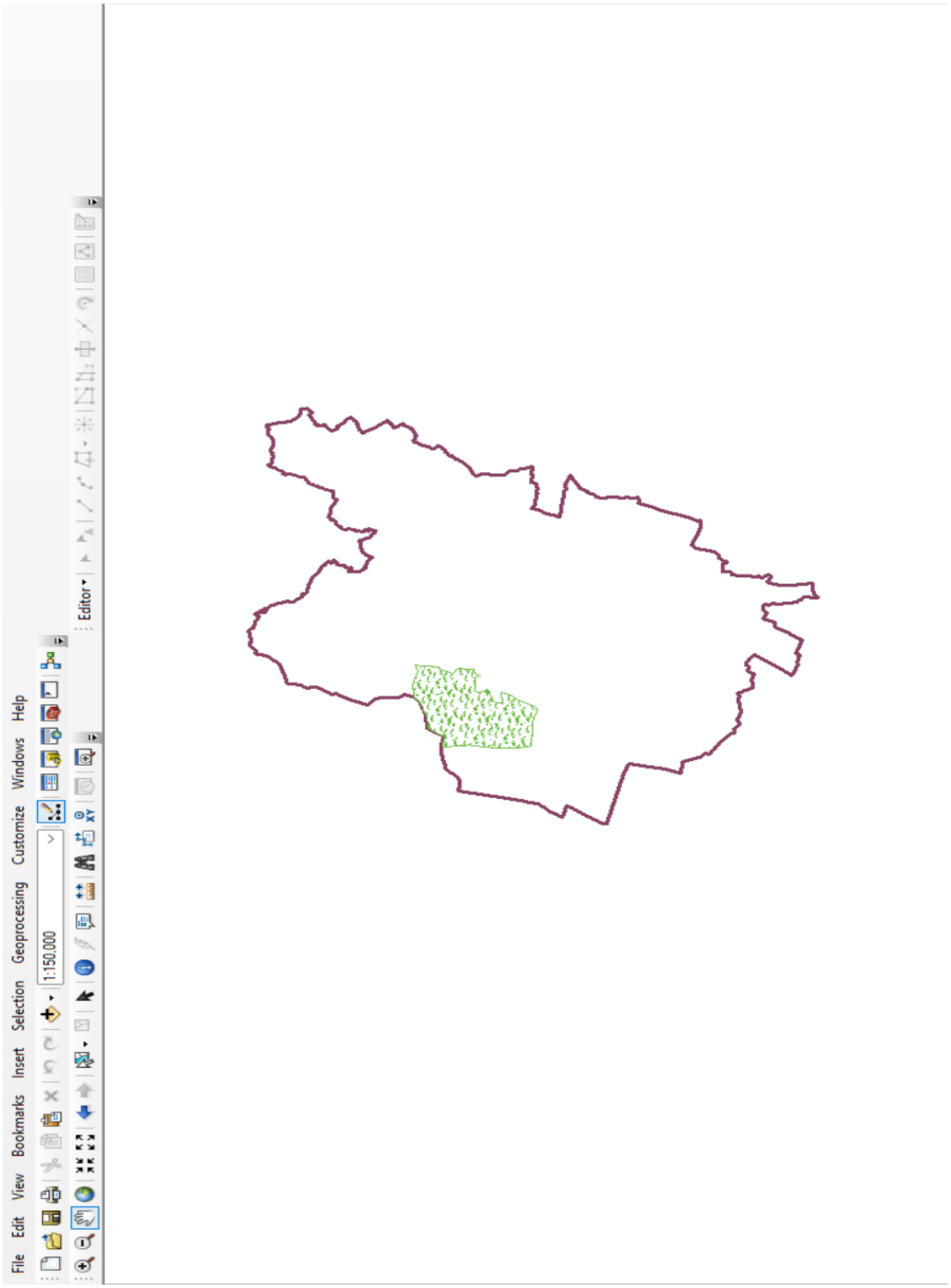

FIG.14: Vector Format Of Forest Cover

SMART CITY DEVELOPMENT SITES

Identification of possible sites for smart city planning

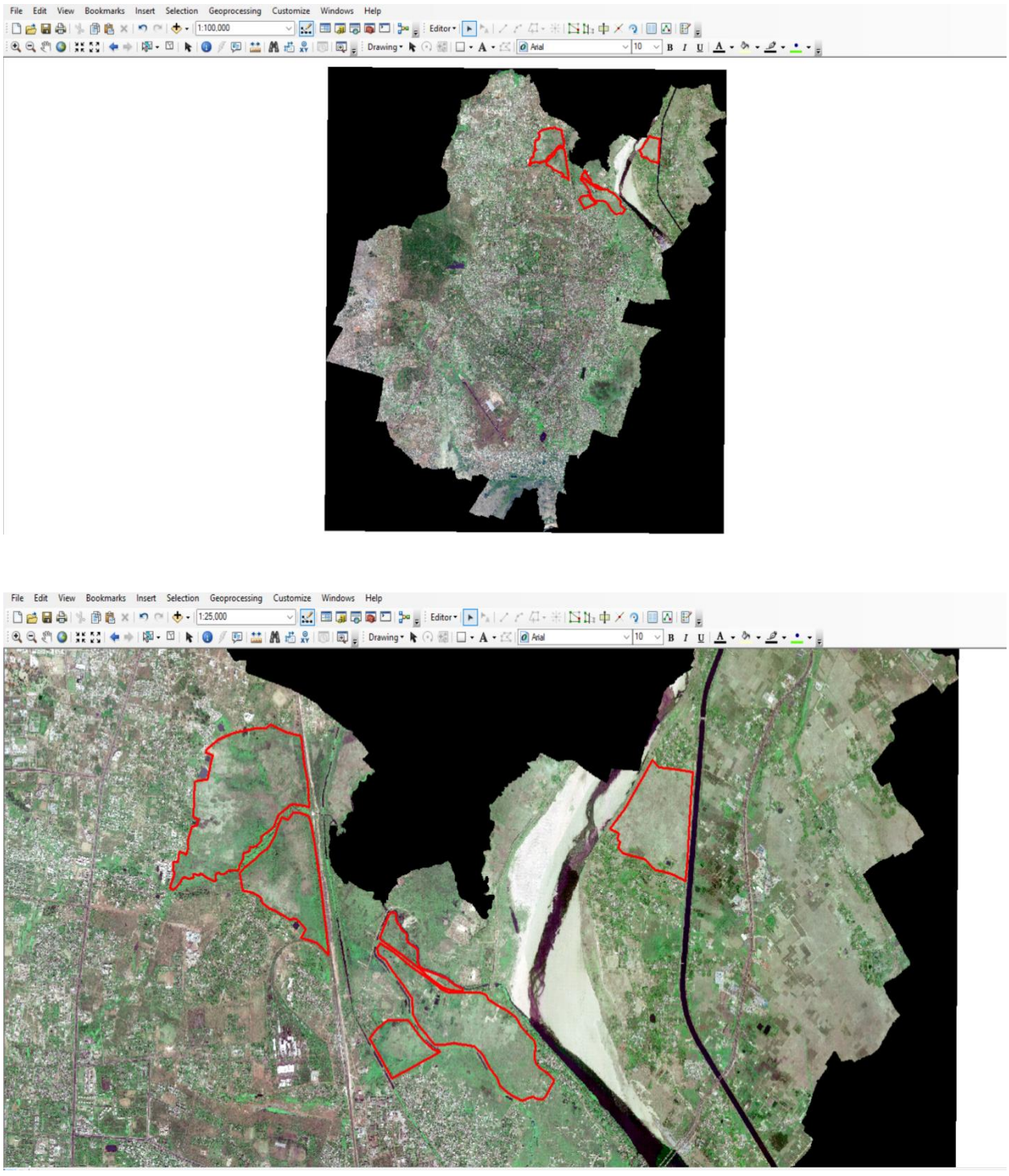

FIG.15 Smart City Development Site

ATTRIBUTE TABLE

Attribute data are the information linked to the geographic features (spatial data) that describe features. That is, attribute data are the "[n]on-graphic information associated with a point, line, or area elements in a GIS."

ATTRIBUTES

- **Labels** affixed to data points, lines, Or polygons.
- Used to describe the feature that you want to map.
- Can include text or numeric descriptors: i.e. nominal, ordinal, or interval/ratio data types.

- Must be careful in how the different data types are integrated and used –dangerous to mix and match.

Attribute tables are the data tables specifically associated with vector or raster files. We use them to understand, query, organize, and symbolize the layers in our maps. While the structure of attributes tables are similar to data tables (they even view the same in the software), they are a unique item when compared to non-spatial data tables.

Calculate Geometry Attributes (Data Management)

Adds information to a feature's attribute fields representing the spatial or geometric characteristics and location of each feature, such as length or area and x-, y-, z-coordinates, and m-values.

Usage

- Length and area calculations will be in the units of the input features' coordinate system unless different units are selected in the Length Unit and Area Unit parameters. If the Coordinate System parameter is specified, the length and area calculations will be in the units of that coordinate system unless different units are specified in the Length Unit and Area Unit parameters.

• The geodesic length and area properties use a shape-preserving algorithm. This produces highly accurate results that are not biased by an assumption that the input line or polygon features are constructed with geodesic arcs between the vertices, which is the assumption regarding traditional geodesic length and area.

• If the input features have a selection, only the selected features will have values calculated in the added fields; all other features will maintain their existing value.

GEOMETRICAL CALCULATIONS FOR THE ROAD LAYER USING GEOMETRICAL CALCULATION TOOL

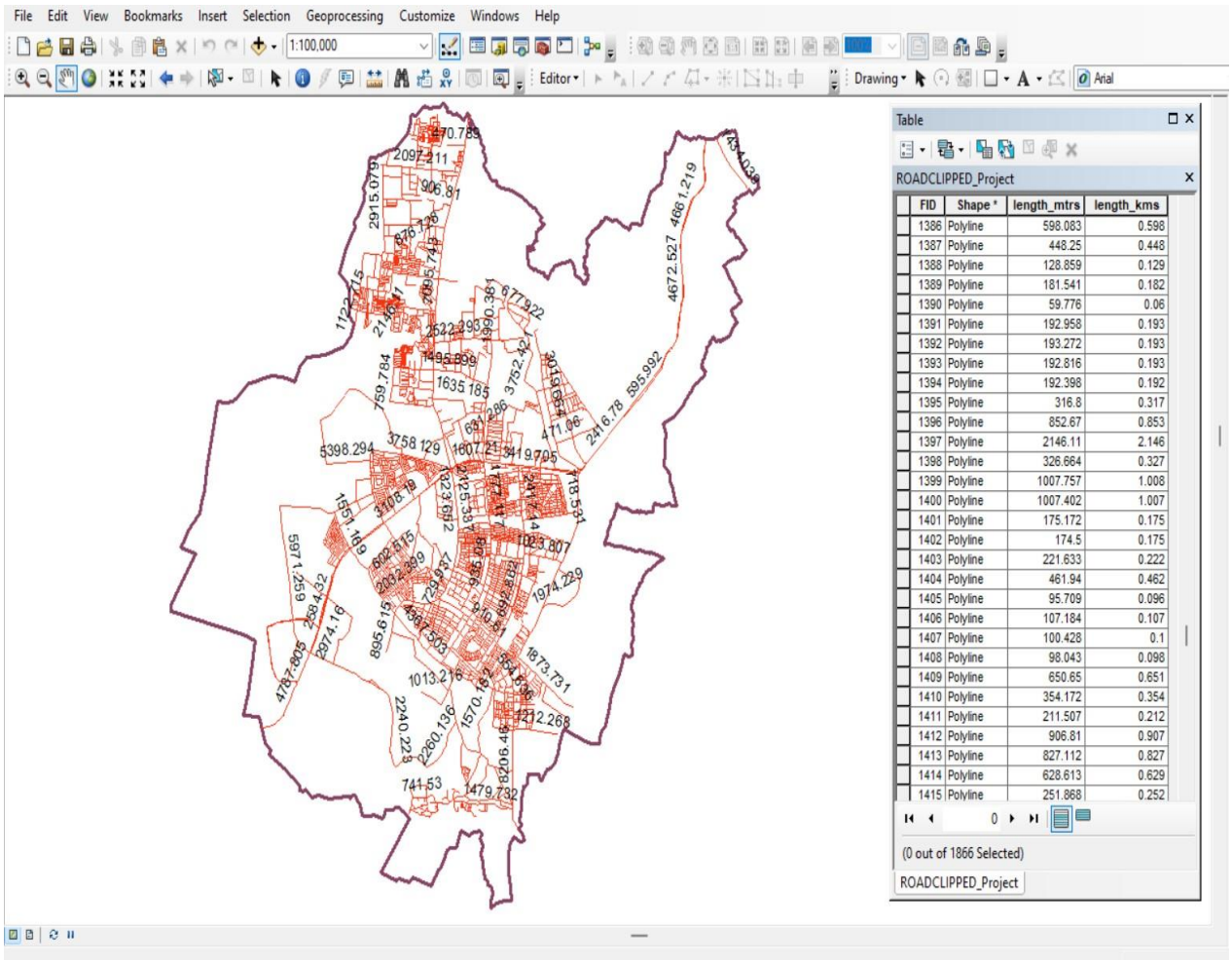

FIG.16 Geometrical Calculations For The Road Layer

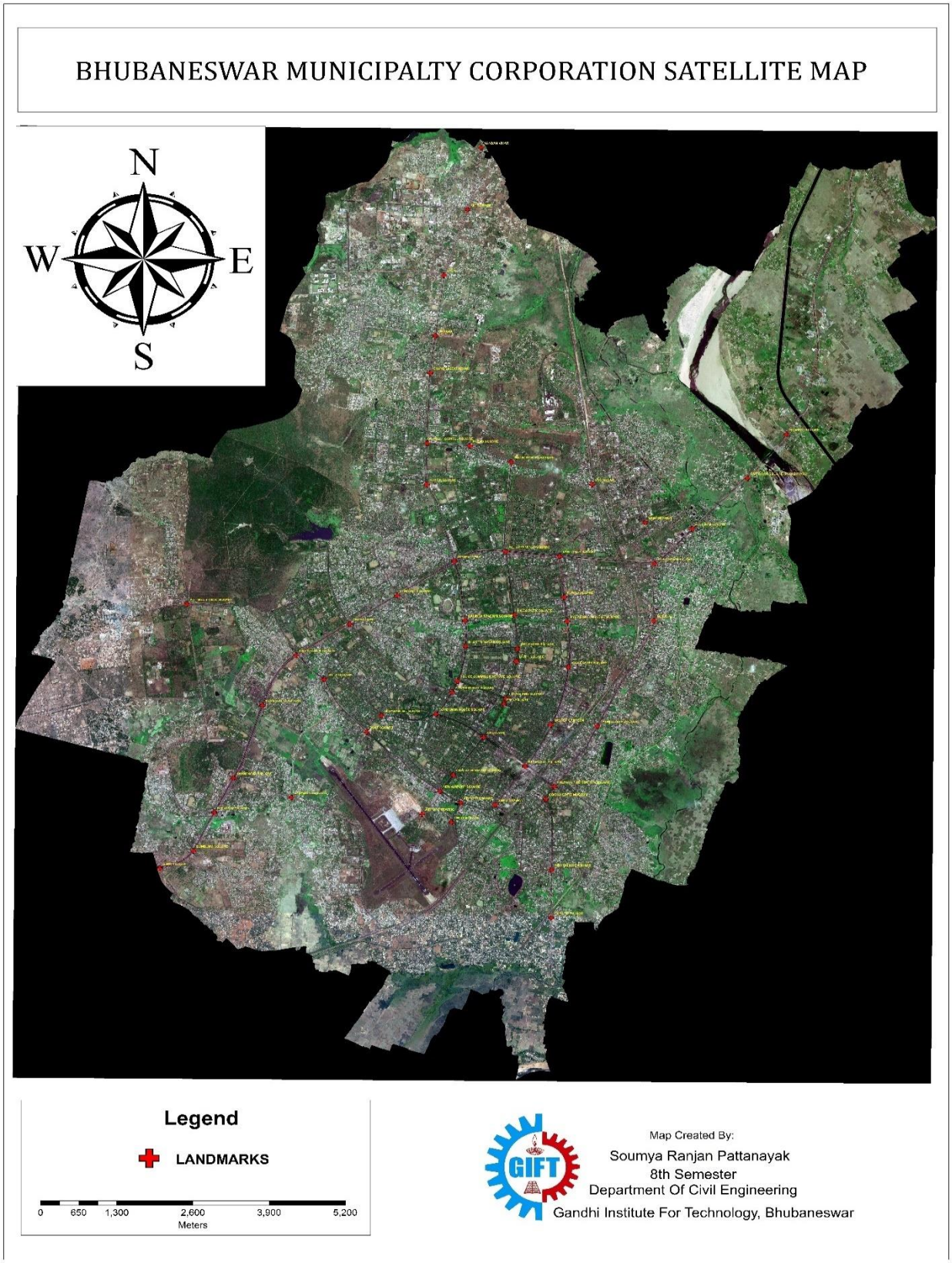

FIG.17 Bhubaneswar Muncilipalty Croporation Satellite Map

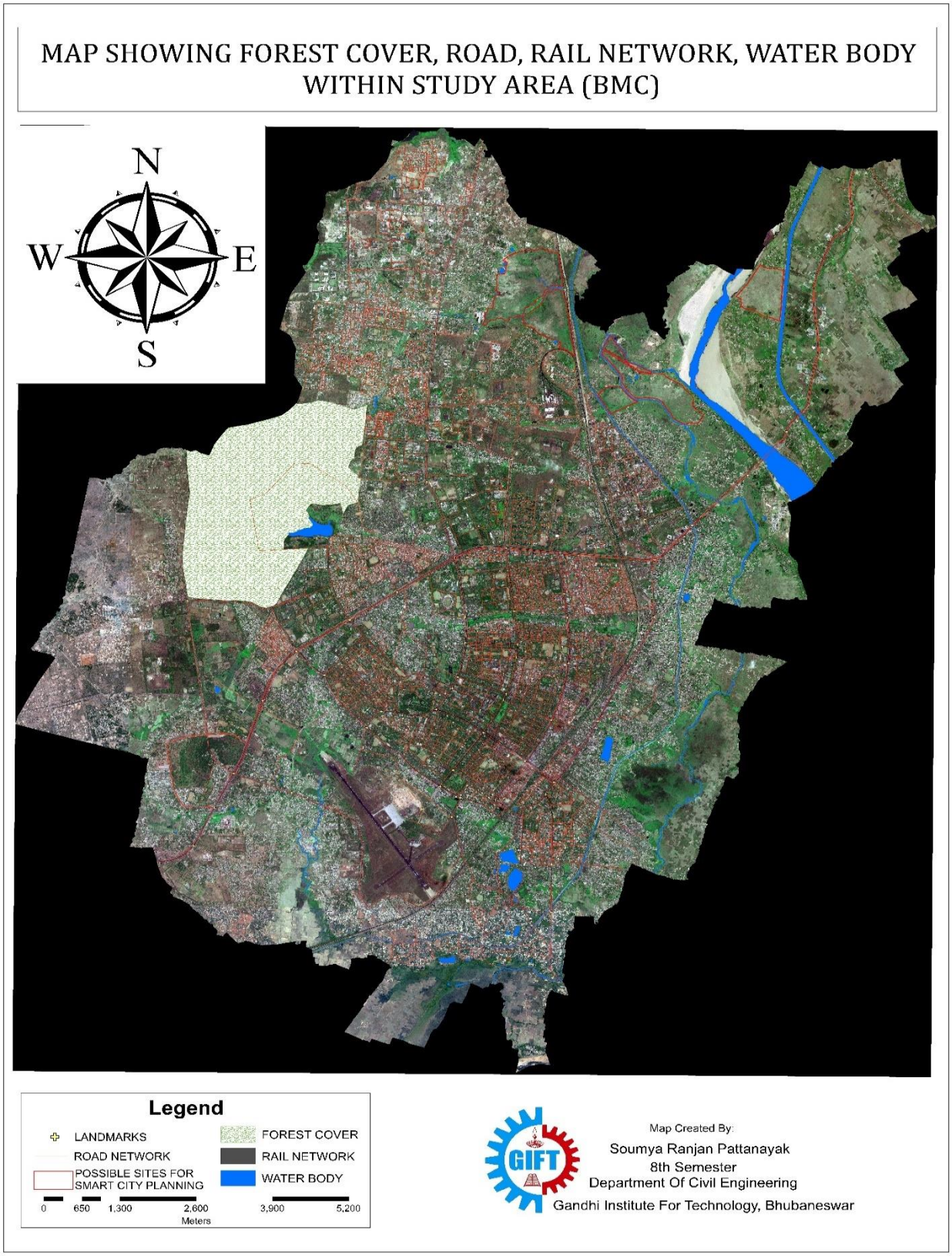

FIG.18 Map Showing Forest, Road, Rail Network, Water Body Within Study Area (BMC)

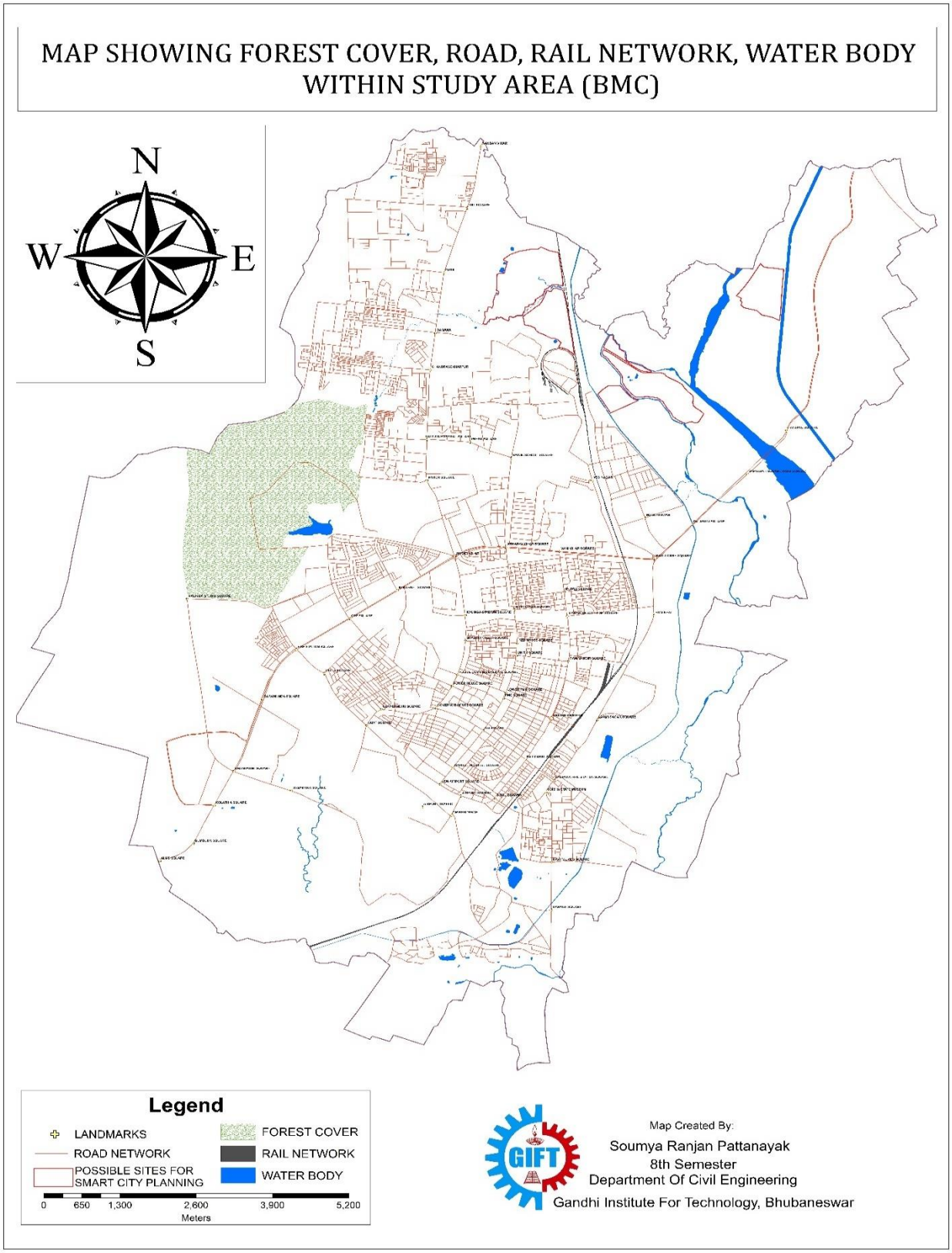

FIG.19 Vector Map Showing Forest, Road, Rail Network, Water Body Within Study Area (BMC)

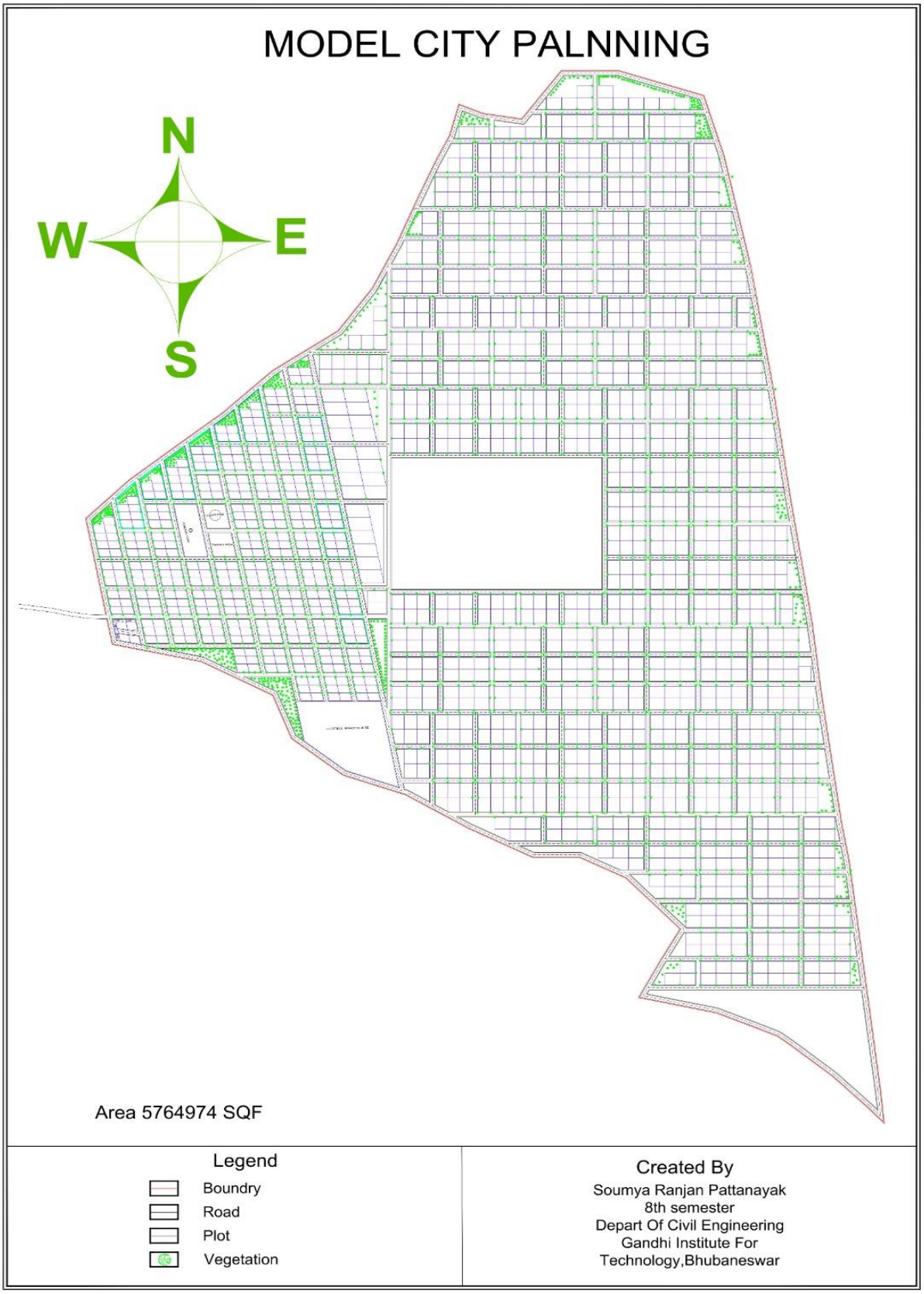

FIG.20 Model City Planning

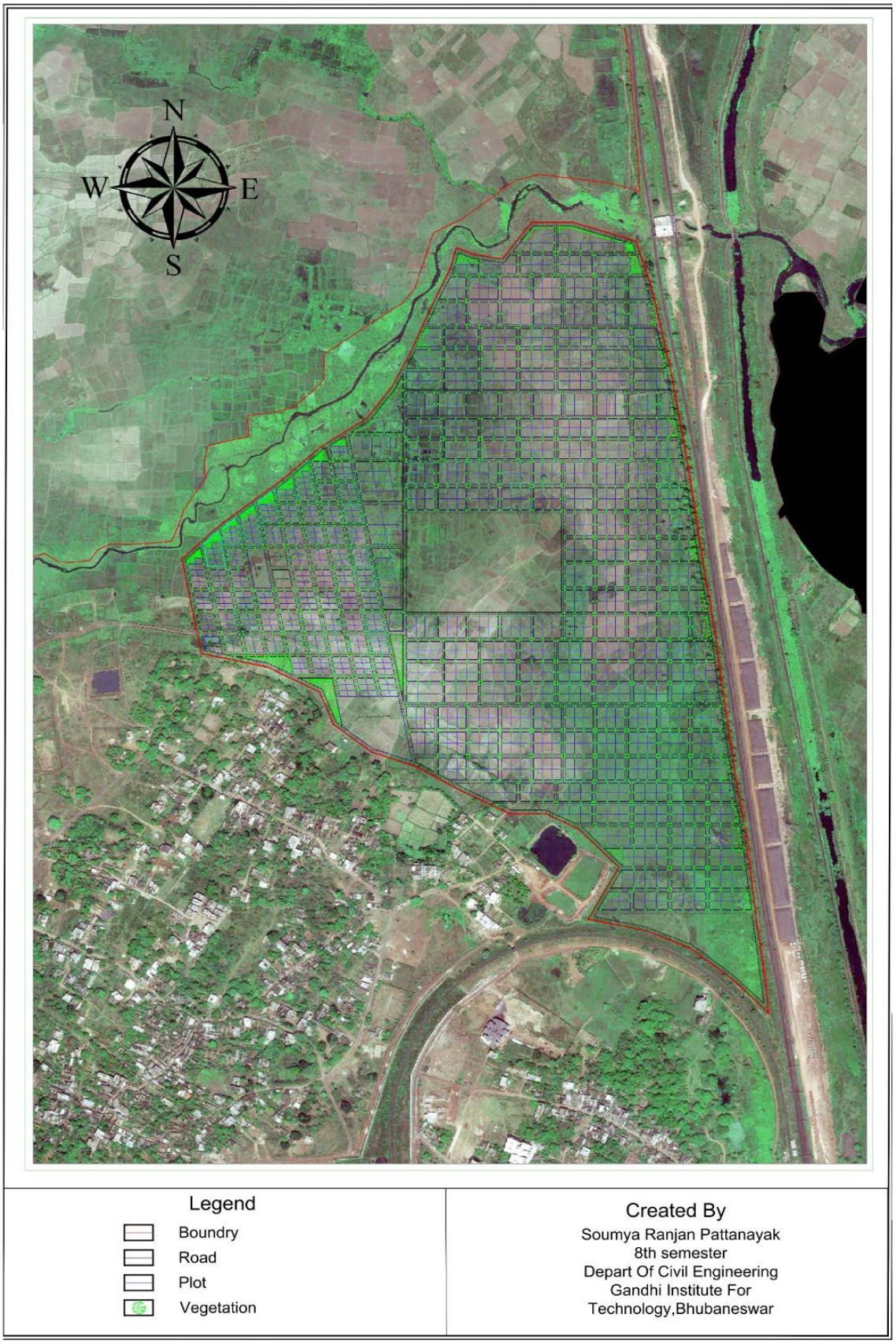

FIG.21 Model City Planning With Satellite Image

CHAPTER V

CONCLUSION

CHAPTER V

CONCLUSION

This project depicts how the GIS could discover its applications in different part of structural building alongside a couple of cases of keen urban communities in India. GIS has risen up out of the logical research centers, customary cartographer table into the core of urban and provincial organizers, arrangement creators. GIS is a rising procedure which can be adequately utilized for making the ideal utilization of assets in everyday life accordingly it is a basic instrument for changing the urban areas to Smart urban communities. Savvy city has different overpowering advantages for both, government and the residents. The mindfulness and specialized know-what about the GIS is vital for its perpetual utilize GPS into another store of steady, precise data, which is then exhibited in different.

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