

# **GIS DEVELOPMENT & ITS APPLICATION IN GOVERNANCE**

*Presentation By*

**Prof. J.S.Rawat**

**Former National Geospatial Chair Professor**

*under Geospatial Programme,*

*Ministry of Science and Technology, Government of India,*

*New Delhi*

*14<sup>th</sup> December 2023 at UAoA Nainital*

# **GIS & Its Application in Governance**

## ***First Day***

- 1. Concept of GIS**
- 2. Technologies Used**

## ***Second Day***

- 3. GIS Development**
- 4. Digital Mapping and its Visualization**

## ***Third Day***

- 5. Application in Governance**
- 6. Application in Governance**

**Day First 14<sup>th</sup> December,2023**

**10:30am-11:30 am**

# **1.0 CONCEPT OF GIS**

**1.1 Definition of GIS,**

**1.2 Components of GIS**

**1.3 Data Types in GIS**

**1.4 History of GIS**

**Day First 14<sup>th</sup> December,2023**  
**10:30am-11:30 am**

# **1.0 CONCEPT OF GIS**

**1.1 Definition of GIS,**

**1.2 Components of GIS**

**1.3 Data Types in GIS**

**1.4 History of GIS**

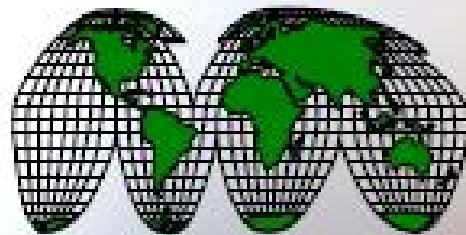
# What is a GIS?

Information System



+

Geographic Position



A means of storing, retrieving, sorting, and comparing spatial data to support some analytic process.

# **APPLICATION OF GIS IN GOVERNANCE:**

**Planning, Development, Monitoring, Management,  
Mapping, Surveying, Navigation**

*Technology Upgradation*

**e-Governance                      to                      g-Governance**

Information with Text/Table/Analog Map

IT/MIS

to

to

Information with Digital Map

GIS/Web GIS

**GIS gives answer of**

**Where ?**

**GIS gives answer of**

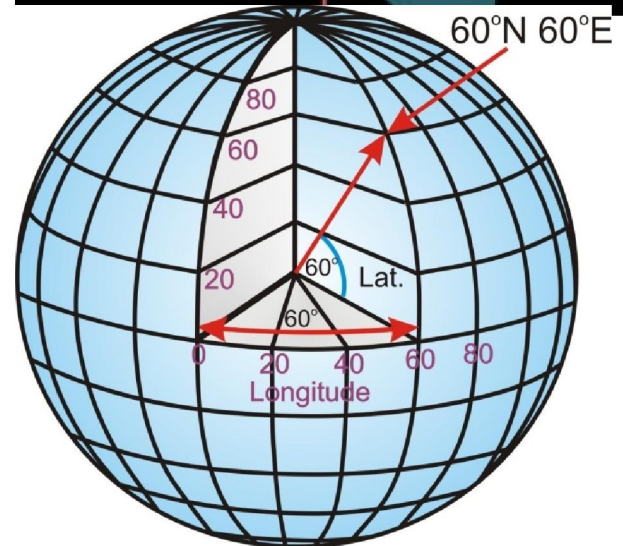
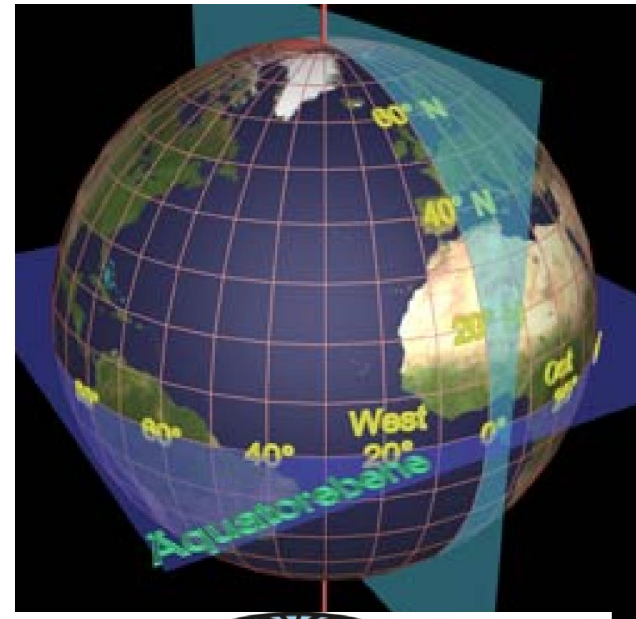
**Where ?**

**Means**

**Geographic Location**

**Latitudes 90N & 90S**

**Longitudes 180E & 180W**



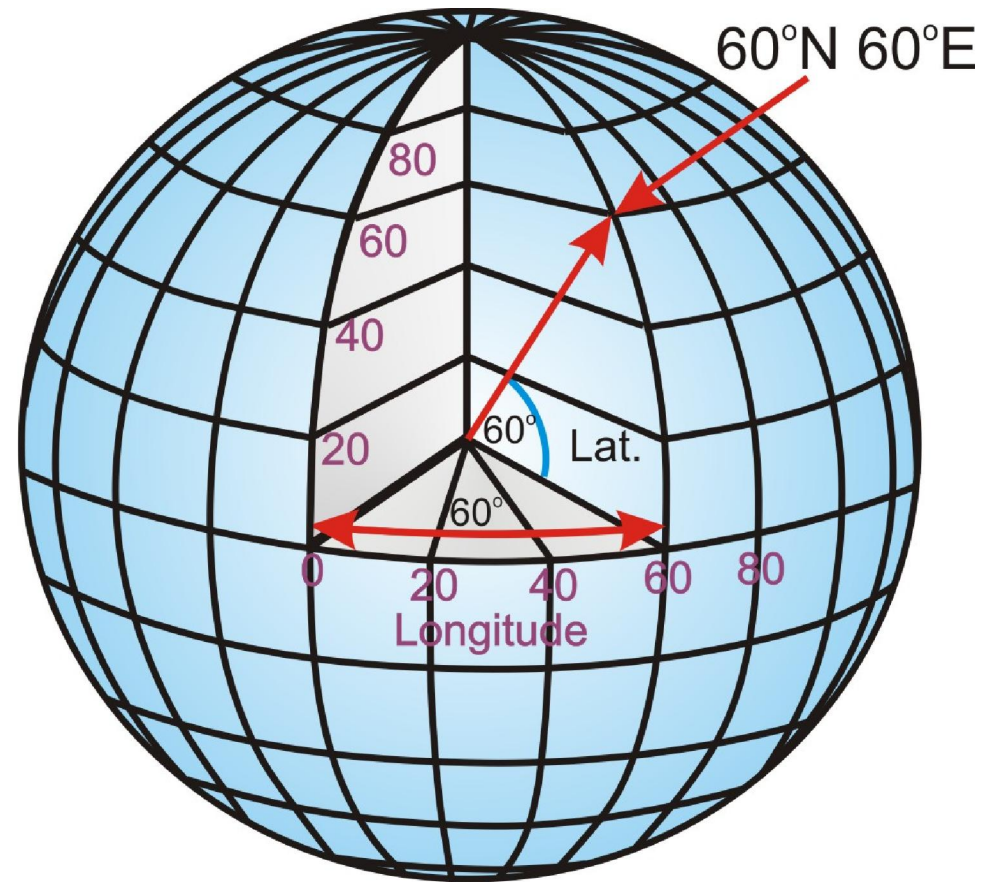
**GIS gives answer of the question**

**Where ?**

**Means**

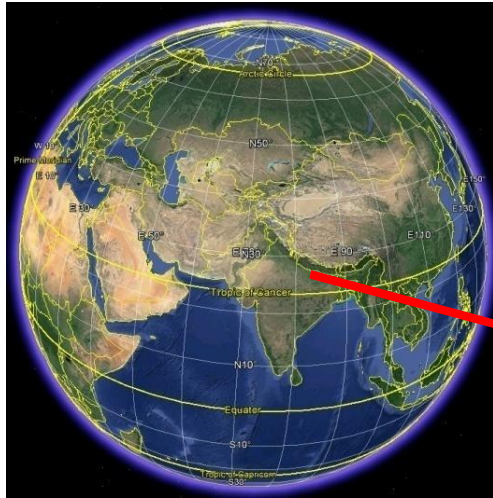
**Geographic Location**

**(Latitude and Longitude)**



**Where is ATI, Nainital?**

# Geographic Location of ATI, Nainital



**Geographic Location of ATI,  
Nainital**

**Address of ATI Nainital  
29d323m36.39s N  
79d36m80.84s E**



**Geocoding/Geostamping/Geotagging/Georeferencing**

**GIS gives answer of**

**Where ?**

**What ?**

**GIS gives answer of**

**Where ? = Spatial**

**What ? = Non-Spatial or Attribute**

Admin - ArcMap - ArcInfo

File Edit View Bookmarks Ins

Attributes of Almora\_Tehsil\_Boundary

FID	Shape*	Id	Name	State	District	Subdistt	No_HH	TOT_P	TOT_M	TOT_F	P_06	M_06	F_06	P_SC	M_SC	F_SC	P_ST	M_ST	F_ST	P_LIT	M_LIT
0	Polygon	0	Jainti	05	064	00332	6349	30981	14809	16172	4761	2444	2317	7583	3767	3816	46	25	21	19708	11182
4	Polygon	0	Someshwer	05	064	00331	9697	40282	18214	22068	5324	2762	2562	12720	5931	6789	82	38	44	27569	14380
8	Polygon	0	Chakhutiya	05	064	00326	10832	46051	20047	26004	5939	3066	2873	8971	3967	5004	42	19	23	32377	15994
5	Polygon	0	Dwarahat	05	064	00329	13087	55068	24372	30696	6790	3561	3229	13929	6443	7486	71	26	45	38379	19316
6	Polygon	0	Sult	05	064	00327	12778	57126	25503	31623	7823	4050	3773	11362	5387	5975	6	3	3	37006	19257
1	Polygon	0	Bhanoli	05	064	00333	12167	57824	26948	30876	8840	4556	4284	15408	7407	8001	23	13	10	35558	19553
7	Polygon	0	Bhikiyasain	05	064	00325	16994	70487	30555	39932	8483	4394	4089	11830	5337	6493	32	16	16	47823	24168
2	Polygon	0	Ranikhet	05	064	00328	22316	100124	49720	50404	12494	6601	5893	24606	12033	12573	184	94	90	75252	41223
3	Polygon	0	Almora	05	064	00330	38357	164563	80913	83650	19628	10238	9390	44586	22423	22163	795	399	396	122825	66531

Record: 1 Show: All Selected Records (1 out of 9 Selected) Options

Layers

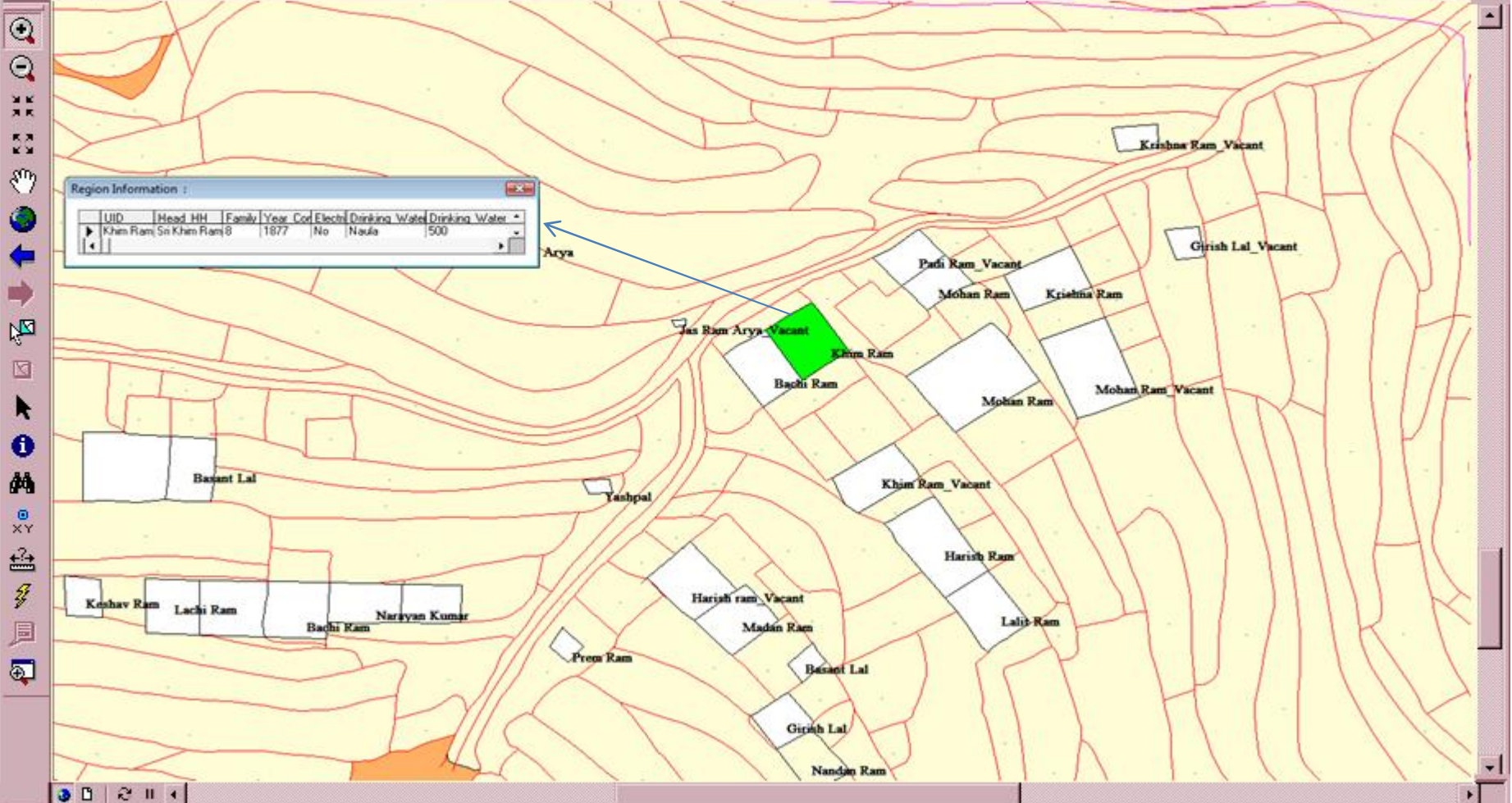
- Almora\_Villages
- Almora\_Block\_Bounda
- Almora\_Tehsil\_Bound
- Tehri\_District\_Bounda

**Add Block Boundary**

Display Source Selection

Drawing Arial 10 B I U A

Open attribute table for this layer 79.823 30.042 Decimal Degrees



**GIS gives answer of**

**Where ? = Spatial**

**What ? = Non-Spatial or Attribute**

**What Should Be? = Science**



# GIS ?

- GIS is a Computer based technology which provides information to the users with digital map by clicking few mouse buttons in the computer.
- GIS has enormous capacity of data capturing, storage, analysis, retrieval manipulation, displaying and transforming from one place to another.
- In 1972, *Roger Tomlinson*, known as the “*father of GIS*”, has specified GIS as a tool for computerized mapping to help in producing maps more cheaply and faster.

# GIS: a formal definition

*“A system for capturing, storing, checking, integrating, manipulating, analysing and displaying data which are spatially referenced to the Earth. This is normally considered to involve a spatially referenced computer database and appropriate applications software”*

**Day First 14<sup>th</sup> December,2023**  
**10:30am-11:30 am**

# **1.0 CONCEPT OF GIS**

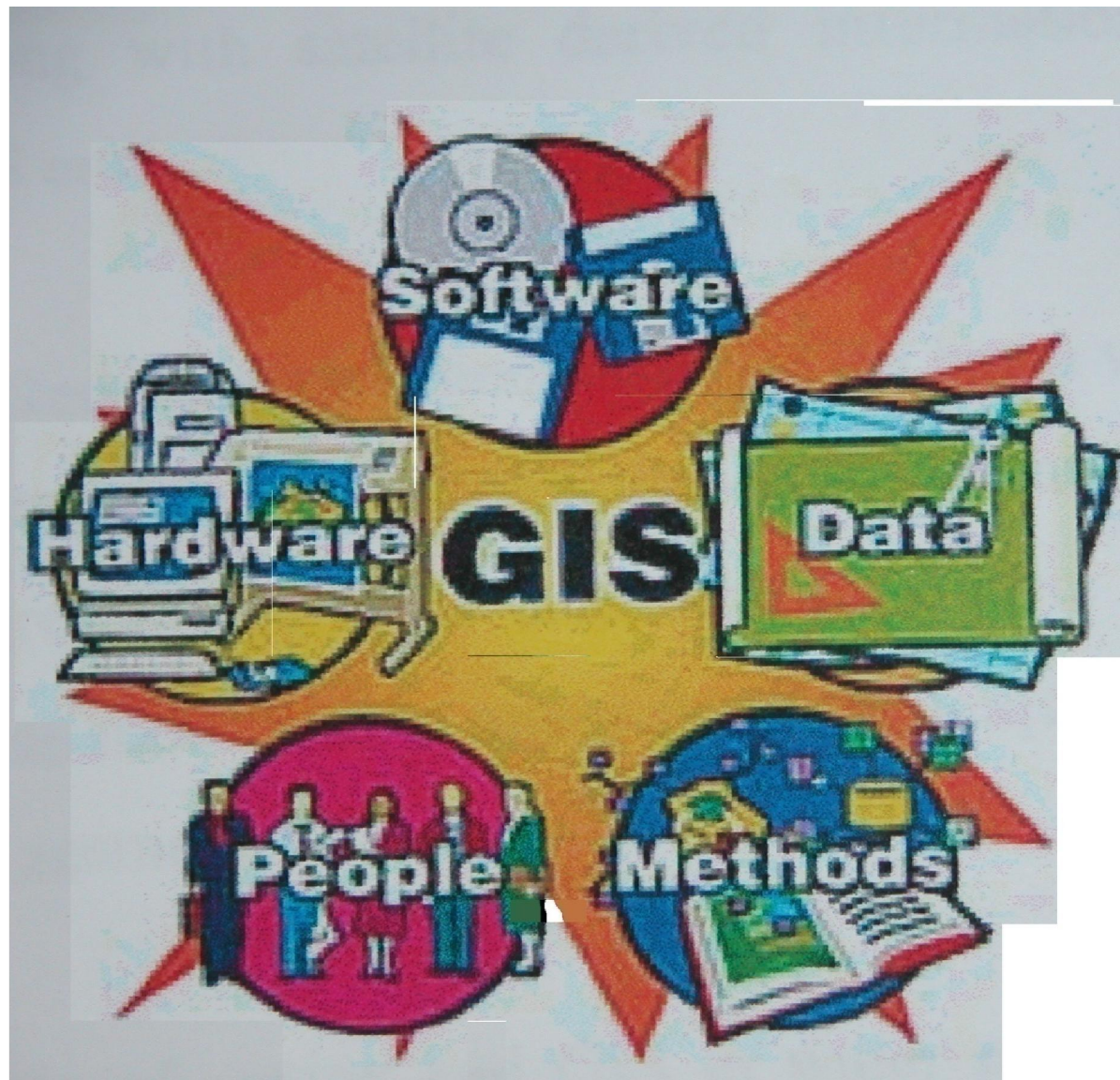
**1.1 Definition of GIS,**

**1.2 Components of GIS**

**1.3 Data Types in GIS**

**1.4 History of GIS**

# COMPONENTS OF GIS



**1. *Hardware System***-The hardware system includes the computer and the operating system to run GIS. Additional equipment may include monitors for display, digitizers and scanners for spatial data input, GPS receivers and mobile devices for fieldwork, and printer and plotter for hard copy data display.

**2. GIS Software** -To develop GIS specific software are required. These are known as GIS software. Some of the important GIS software are: Arc GIS, Geomatica, Gram++, Geomedia etc. The GIS software includes the program and the user interface for driving the hardware. Common user interfaces in GIS are menus, graphical icons, command lines etc.



**3. Data** -Data is one of the most important components of GIS more than 70 % GIS project cost lies in data capture. The database is the primary asset of GIS. After gathering the raw data, it must be edited to remove errors and archived. The following are some of important data that are used to GIS.: Maps, Aerial photography, Satellite image, GPS and DROAN.

**4. *Methods***- Methods refer to the knowledge of handling hardware and GIS software. This constitutes an important component of GIS because without the knowledge of methods and techniques of hardware and GIS software it would not be possible to develop GIS.

***5. User/People*** -People refer to GIS professionals and users who define the purpose and objectives, and provide the reason and justification for using GIS.

# COMPONENTS OF GIS



**Day First 14<sup>th</sup> December,2023**

**10:30am-11:30 am**

# **1.0 CONCEPT OF GIS**

**1.1 Definition of GIS,**

**1.2 Components of GIS**

# **1.3 Data Types in GIS**

**1.4 History of GIS**

# **TYPES OF GIS DATA**

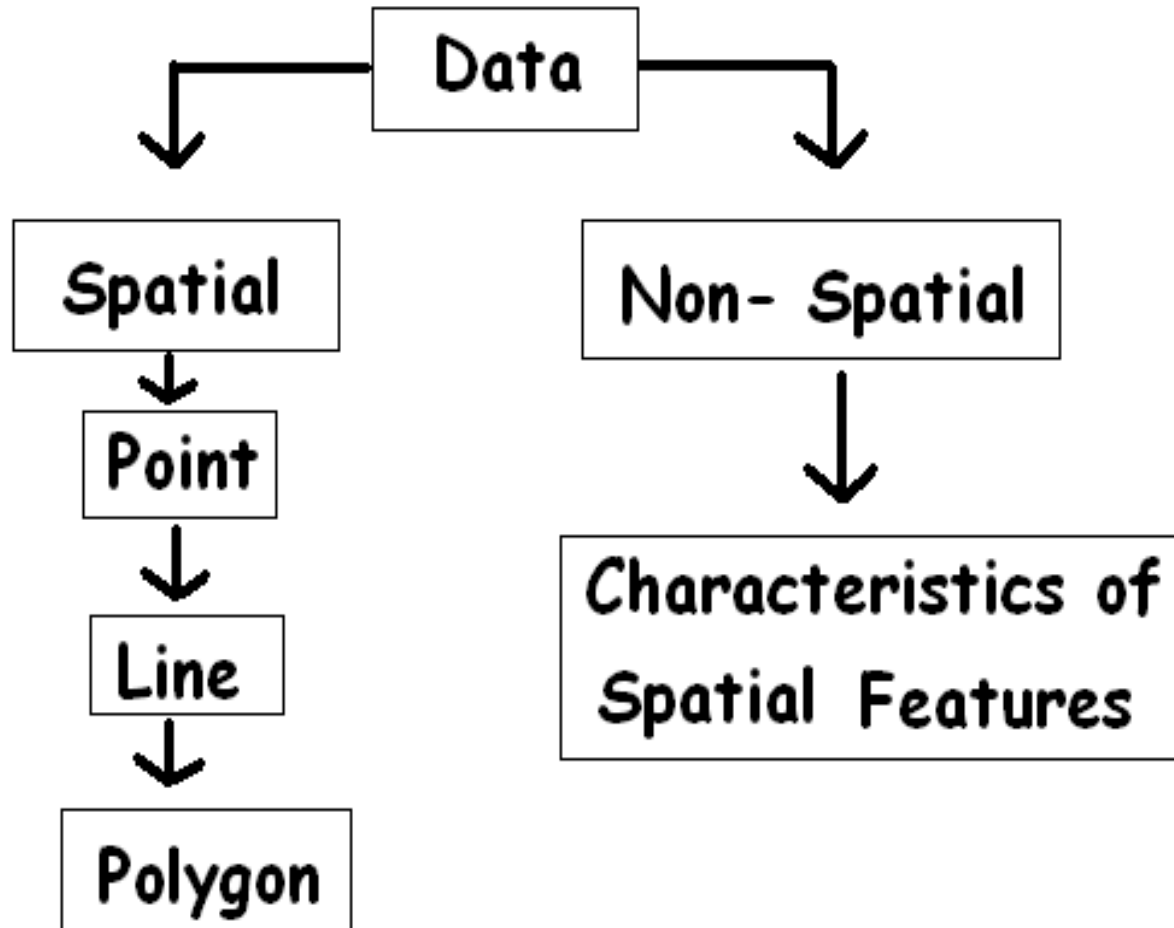
**1.Spatial Data**

**2.Non-Spatial Data**

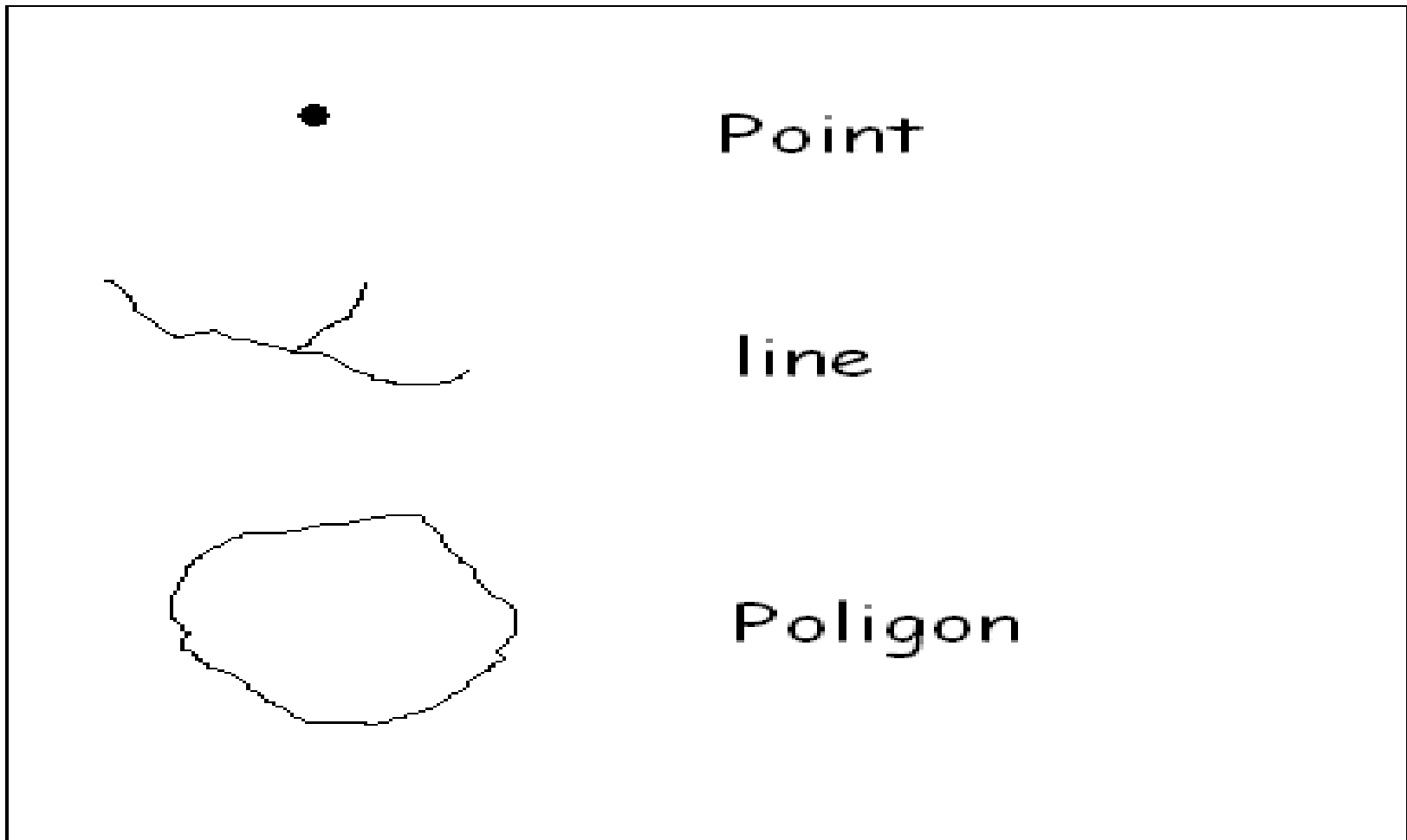
**3 Raster Data**

**4 Vector Data**

# **GIS DATA LAYERS**



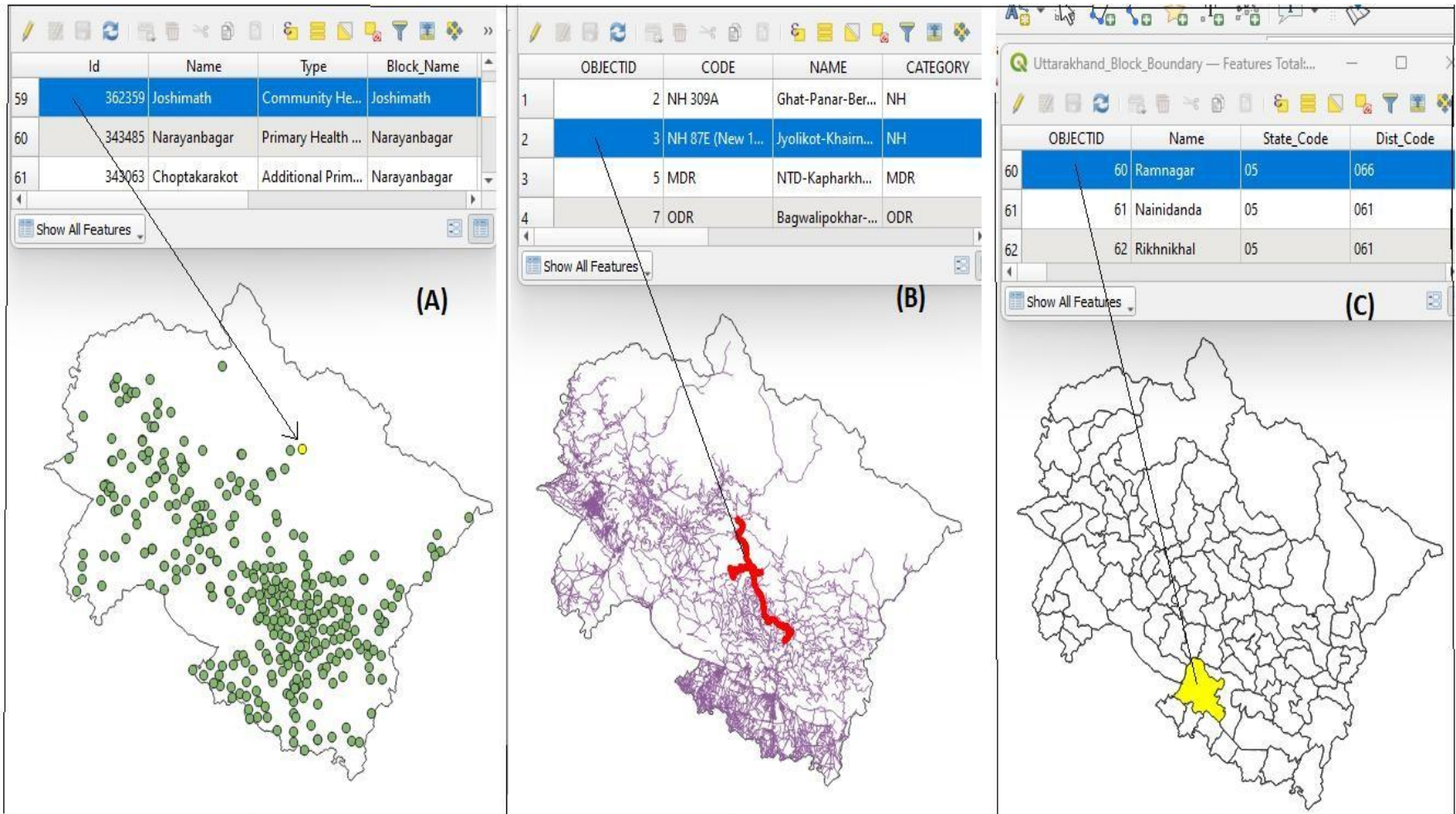
# Geometry of GIS Data Layers



- ***Point Data Layer*** - A point is represented by a single x, y coordinate pair. Points can represent the location of a geographic feature or a point that has no area, such as a mountain peak or location of towns or villages etc .
- ***Line Data Layer*** -A line is a set of line segments and represents a linear geographic feature, such as a river , road, or utility line. Lines can also represent non-geographical boundaries, such as voting districts, school zones, contour lines, etc.
- 
- ***Polygon Data Layer*** -A polygon is a closed line or closed set of lines defining a homogeneous area, such as soil type, land use, or block map etc. Polygons can also be used to represent non-geographical features, such as wildlife habitats, state borders, commercial districts, etc.

# Spatial Data

## Point, Line and Polygon



# Spatial (Point) Layer with Non-Spatial (Attribute) Data

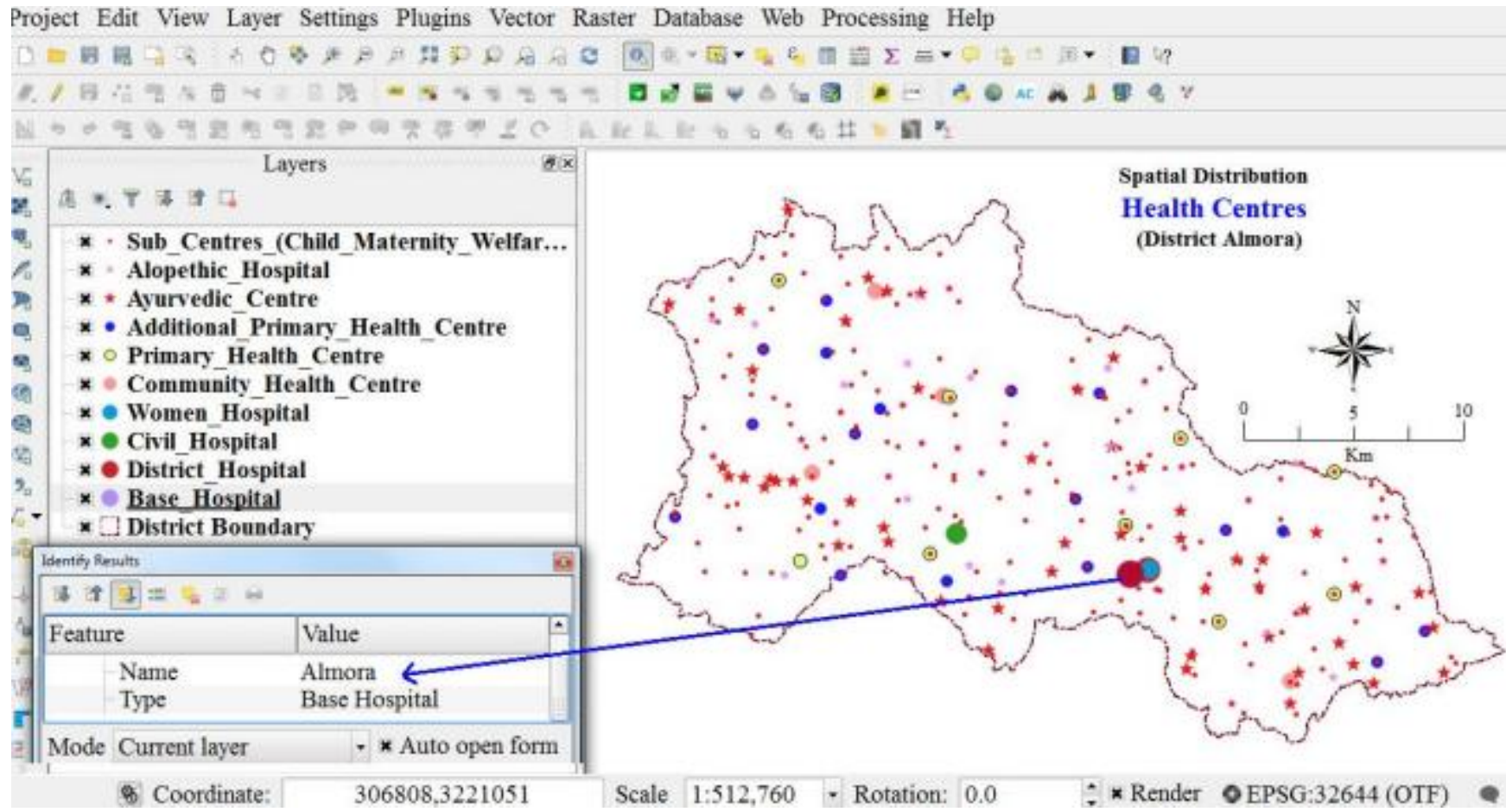
The screenshot displays a GIS application interface. On the left, the 'Identify' window is open, showing a table of attributes for a selected point feature. The 'Location' is specified as 79.674584 29.631075 Decimal Degrees. The table lists various fields such as Village Name, Tehsil Name, Block Name, and administrative details. On the right, a map view shows a geographical area with a red arrow pointing to a specific location, likely corresponding to the 'Bait Bari' entry in the attribute table. The map includes labels for various villages and landmarks, and a toolbar at the top right indicates the current layer and georeferencing status.

Field	Value
Village_Na	Bait Bari
Tehsil_Nam	Almora
Block_Name	Hawalbag
Distance_T	4
Distance_D	4
Patwari_Ar	NTD
Patwari_Ch	Paperseli,Balta
Patwari_Na	Kamal Ashraf
Patwari_Ph	9412344790
Patwari_Ad	NTD
Patwari_Pe	Nandan Singh
Patwari_1	9837666820
Patwari_2	Bakh
Patwari_3	1.5
Apporch_To	By Foot_Khachchar
SK_Area	Sadar Thesil Headquarter
SK_Name	G.D.Tiwari
SK_Ph	9412093070
SK_Add	Almora
SK_Office_	4
Nyaya_Panc	Phalsima
VDO_Name	Rajendra Dharamsattu
VDO_Ph	9412044340
VDO_Add	Bhasbhida
Gram_Pardh	Lacham Singh
Gram_Par_1	9411335180
Gram_Par_2	Bhalyuda
BDC_Member	Balwant Singh
BDC_Memb_1	9411516220
BDC_Memb_2	Balta
BDO_Name	K.C.Joshi
BDO_Ph	9410525720
BDO_Add	Officers Colloni
Block_Pram	Asha Arya
Block_Pr_1	9410711000
Bkock_Pram	Sarson
Population	63
Populati_1	30
Populati_2	33
Nearst_Roa	Almora_Kasardevi
Nearst_Th	Almora
Thana_Dist	4.5
Nearst_He	Paltan Ground
Helipad_Di	5
Sensivit	Earthquake
Past_Incid	NO
Electricit	YES
Water_Sour	Jal Sansthan,Natural Source
Health_Cen	Distt Hospital,Almora
Health_Emp	Full Staff
Health_C_1	2
Doctor_Nam	Dr. Anil Dhingra,Dr.Pant,Dr.Neeraj Tripathi
Doctor_Ph	230064
Other_Staf	Not Available
Other_Ph	0
Nearst_PD	Paparshelli
PDS_Distan	0.5
PDS_Shopke	Umesh Chandra Tiwari
PDS_Ph	235447
Shelter	Not Available
Shelter_Ca	0
Volunteers	Kheem Singh,Bhawan Singh,Narendra Singh,Dhan Singh
Blood_Dona	Blood Bank_Distt Hospital
Blood_Grou	Not Available
Blood_Do_1	0
Community	NONE

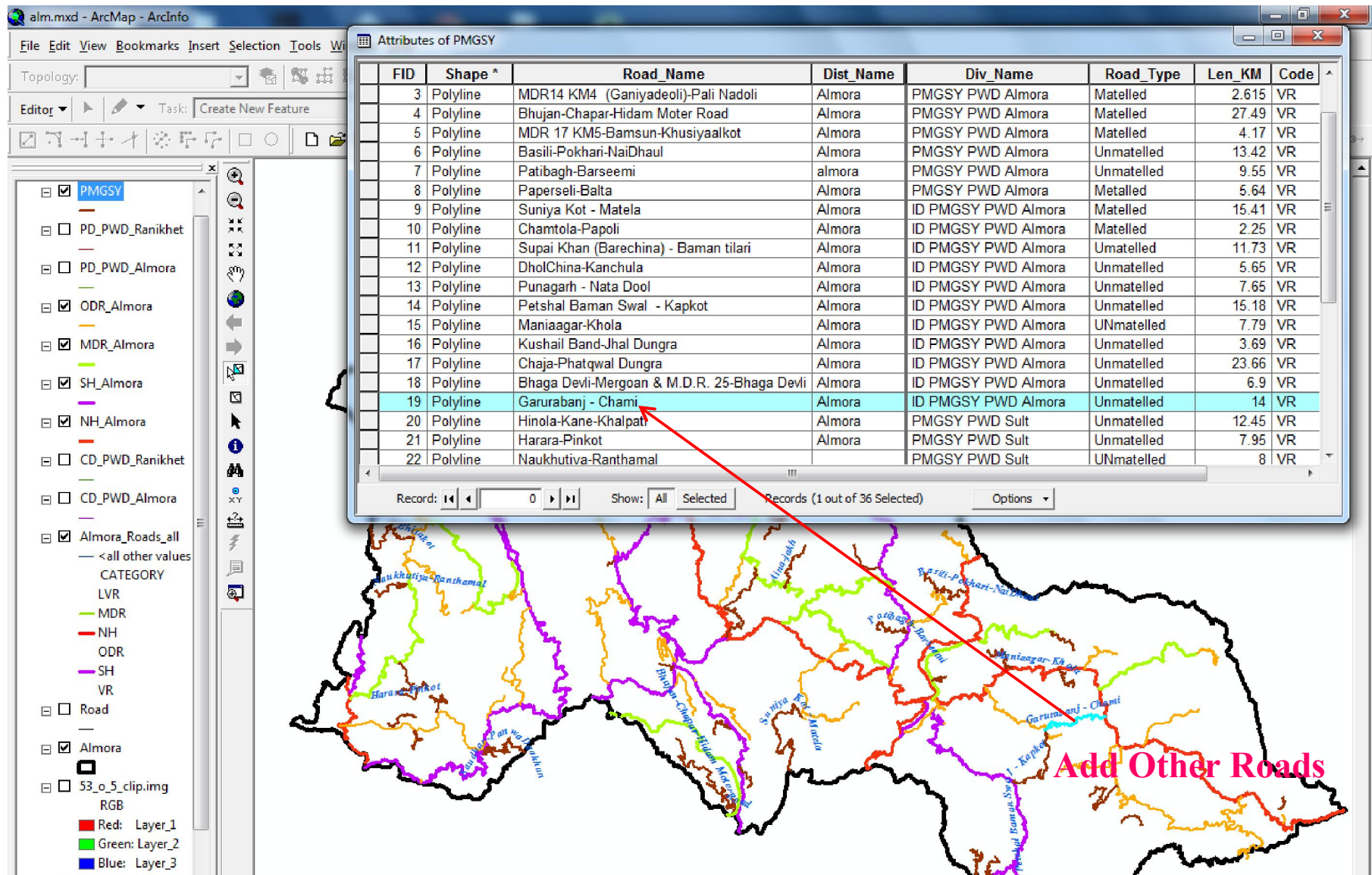
# Spatial Data Model

## Department of Health

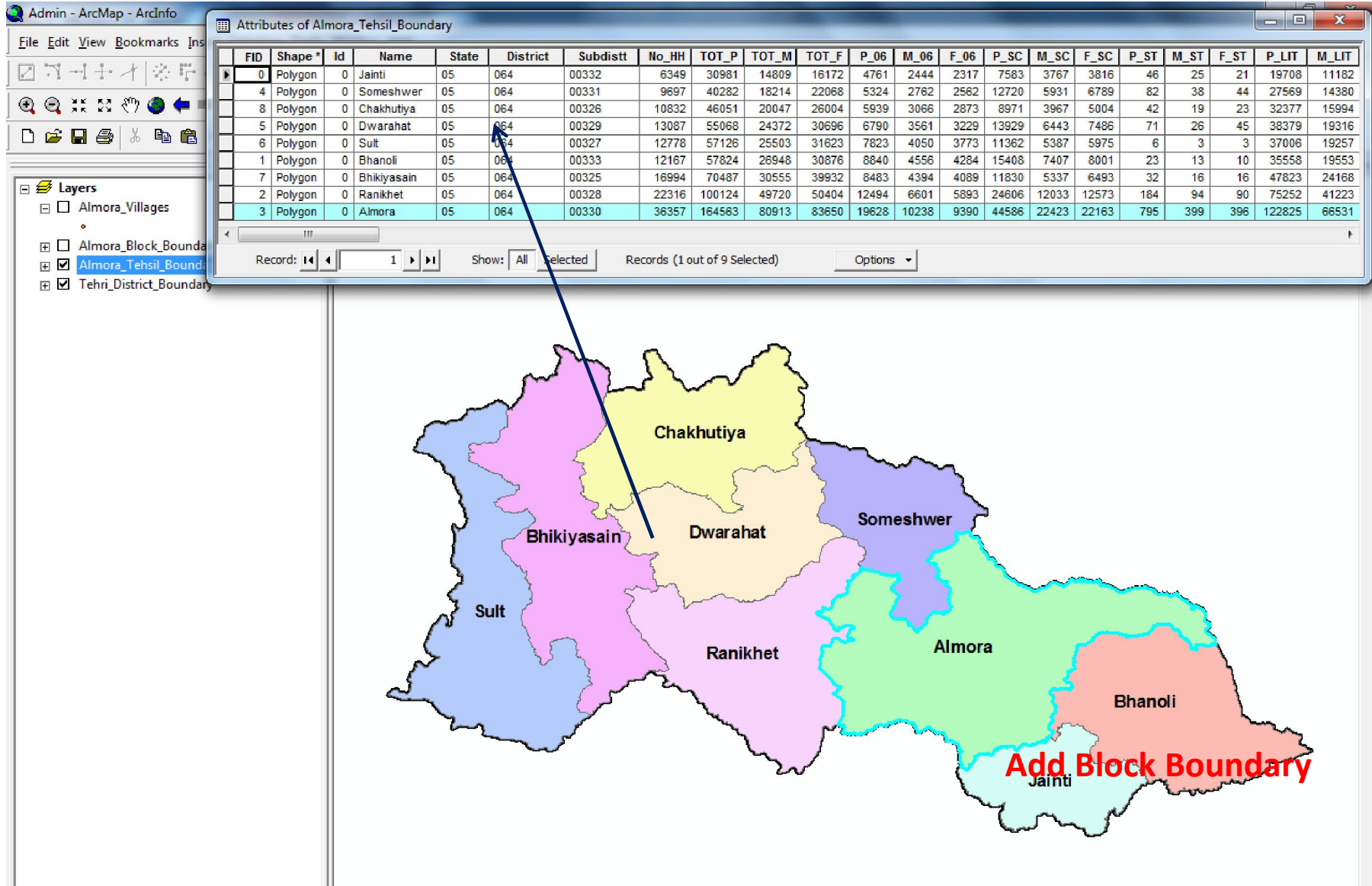
### District Almora



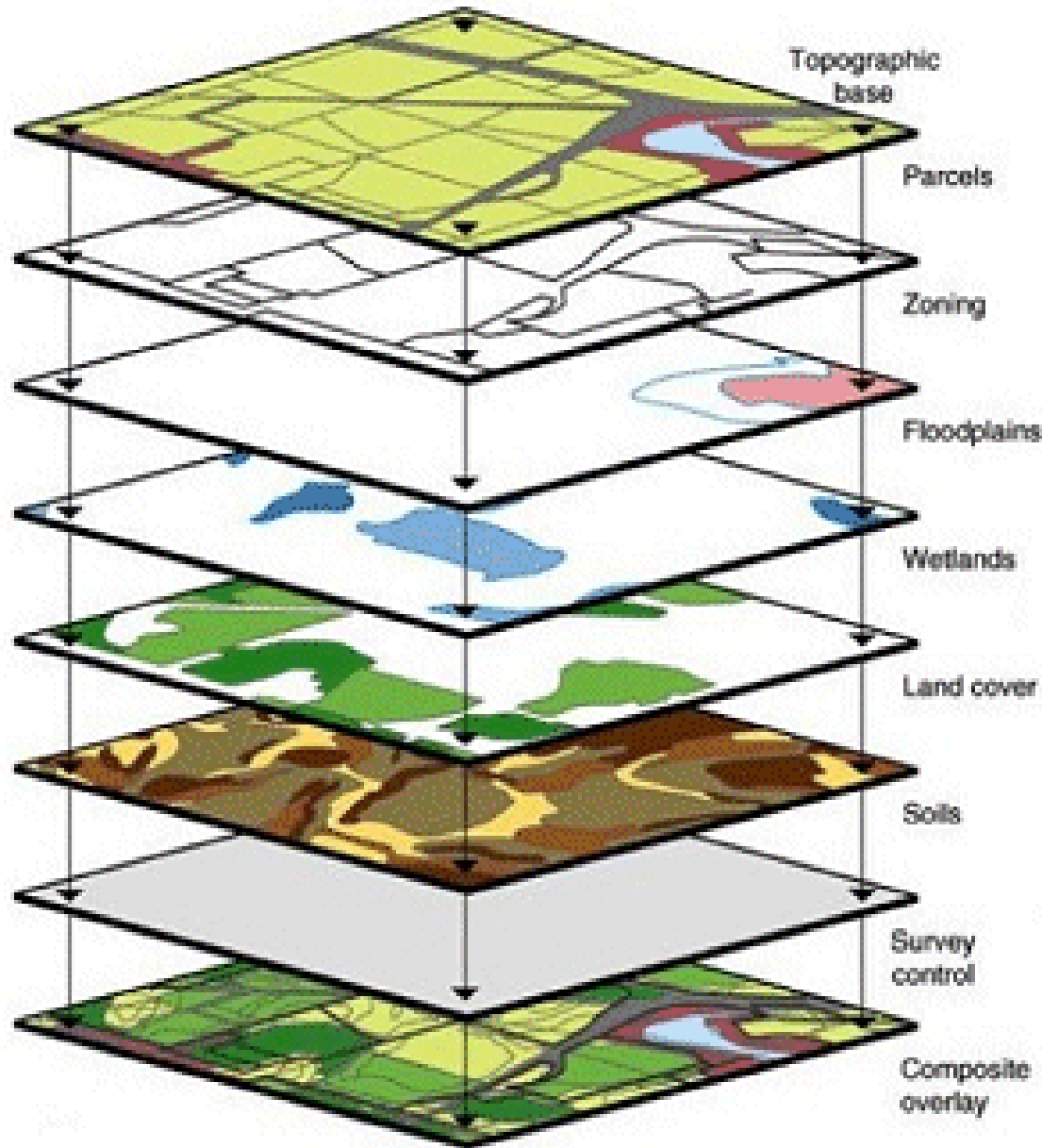
# Spatial (Line ) Layer with Non-Spatial (Attribute) Data



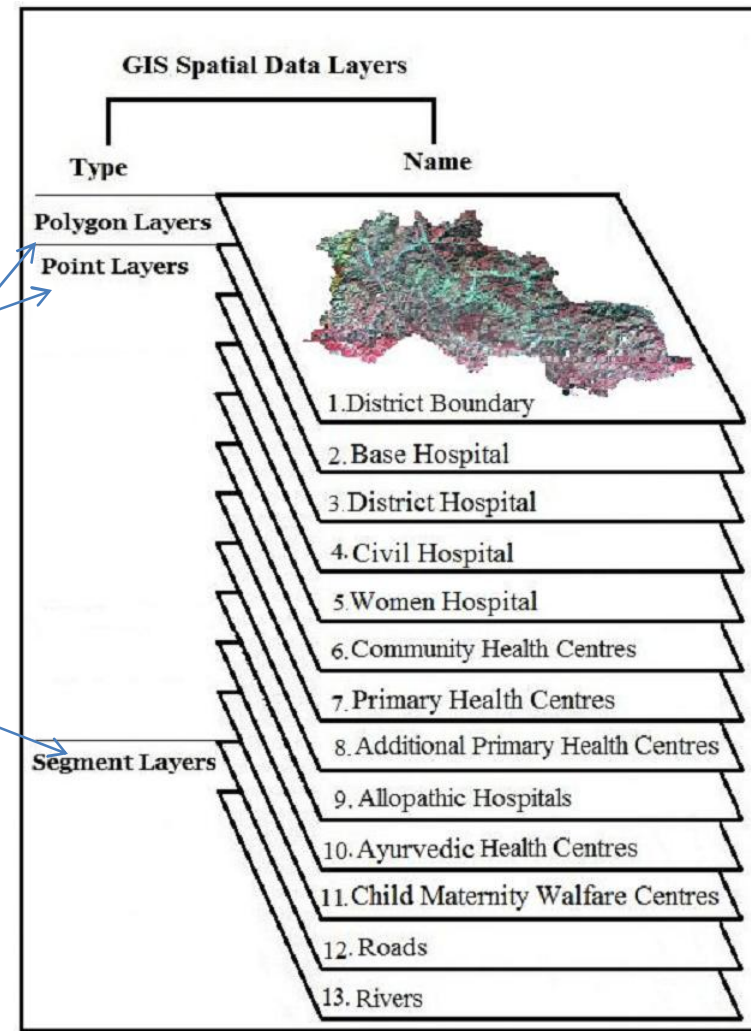
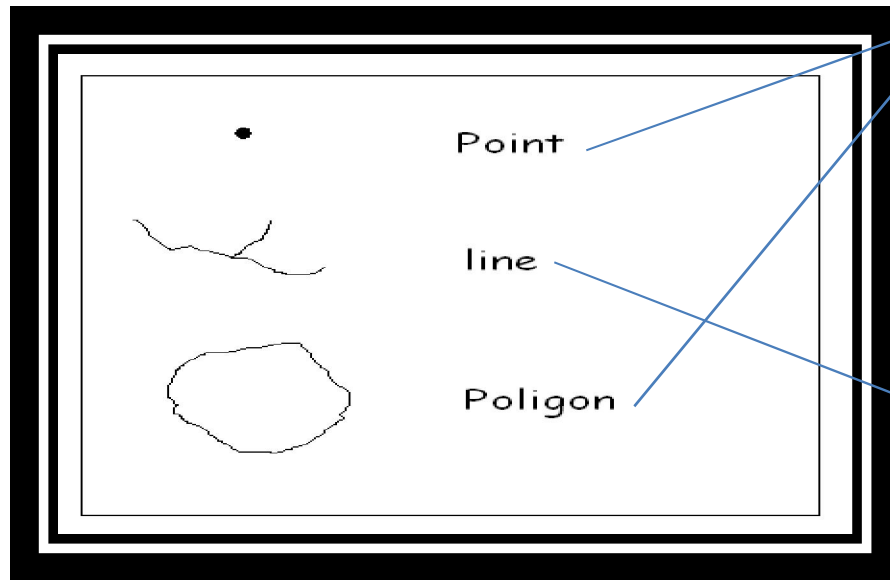
# Spatial (Polygon ) Layer with Non-Spatial (Attribute) Data



# GIS DATA LAYERS

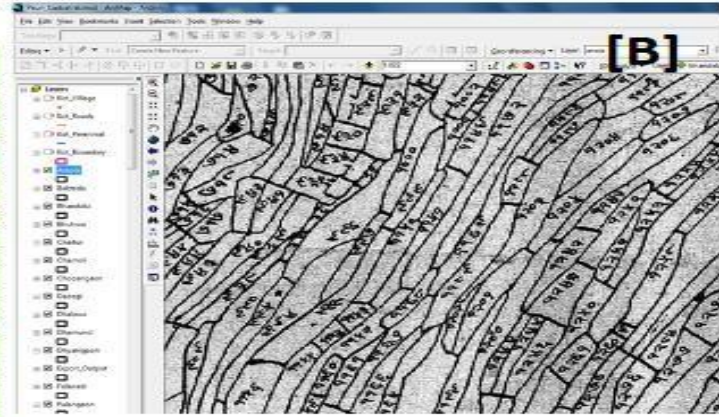
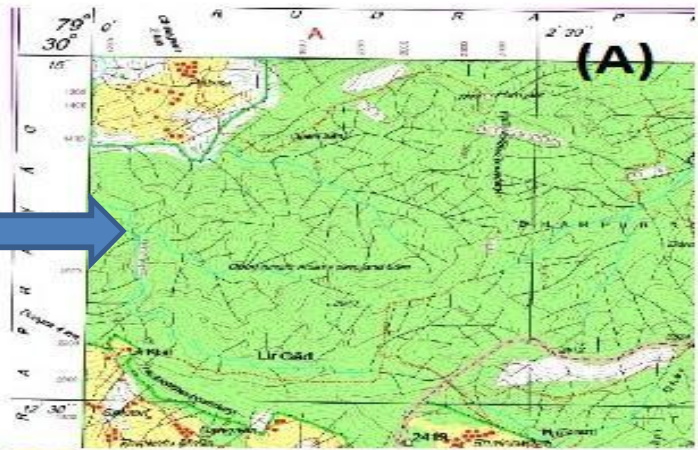


# GIS DATA LAYERS



**RASTER  
AND  
VECTOR DATA**

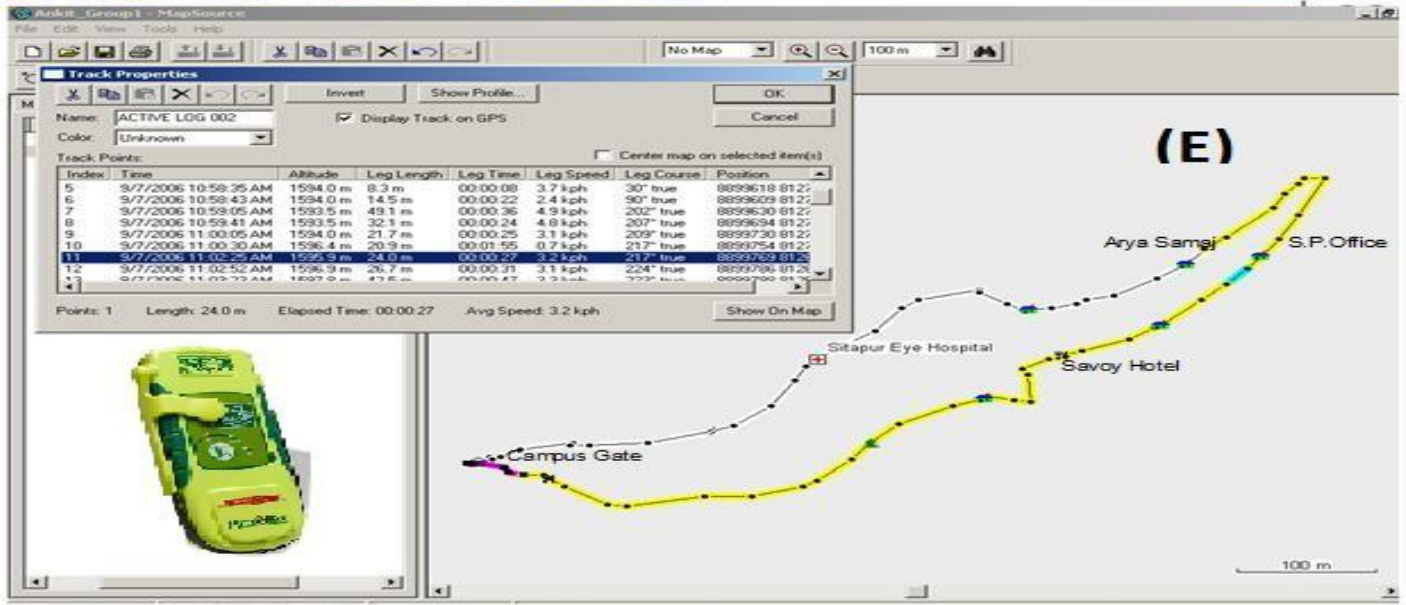
Vector  
Data



Raster  
Data



Vector  
Data



**Day First 14<sup>th</sup> December,2023**  
**10:30am-11:30 am**

# **1.0 CONCEPT OF GIS**

**1.1 Definition of GIS,**

**1.2 Components of GIS**

**1.3 Data Types in GIS**

**1.4 History of GIS**

# History of GIS

- *Period of Computer-Aided Thematic Mapping (1950s)*
- *Period of Geographic Information System (1960s)*
- *Period of GI Technology (1970s)*
- *Period of Matured GI Technology (1980s)*
- *Period of Global Development of GI System (1990s)*
- *Period of GI Science (2000 onward)*

# “The Father of GIS”



Dr. Roger F. Tomlinson  
(1933–2014)

It was Dr. Roger F. Tomlinson who first coined the term *geographic information system* (GIS). He created the first computerized geographic information system in the 1960s

# Father of GIScience



## Michael Frank Goodchild

(born February 24, 1944)

is a British-American geographer. He is an Emeritus Professor of Geography at the University of California, Santa Barbara. After nineteen years at the University of Western Ontario, including three years as chair, he moved to Santa Barbara in 1988, as part of the establishment of the National Center for Geographic Information and Analysis, which he directed for over 20 years.<sup>[1]</sup> In 2008, he founded the UCSB Center for Spatial Studies.

**THANK YOU**

**Day First, 14<sup>th</sup> December, 2023**

**11:45am -1:30 pm**

## **2.0 GIS Data Inputs Technologies**

**2.1. Topographic Maps,**

**2.2 Cadastral Maps,**

**2.3 Aerial Photography,**

**2.4. Satellite Remote Sensing,**

**2.5 GPS/DGPS,**

**2.6 Drone,**

**Day First, 14<sup>th</sup> December,2023**

**11:45am -1:30 pm**

## **2.0 GIS Data Inputs Technologies**

**2.1. Topographic Maps,**

**2.2 Cadastral Maps,**

**2.3 Aerial Photography,**

**2.4.Satellite Remote Sensing,**

**2.5 GPS/DGPS,**

**2.6 Drone,**

# MAPS

**A map is a graphic representation or scale model of spatial concepts. It is a means for conveying geographic information. It is most important input source in GIS, through this GIS expert produced real world features in the form vector data. Two types of maps as given below:**

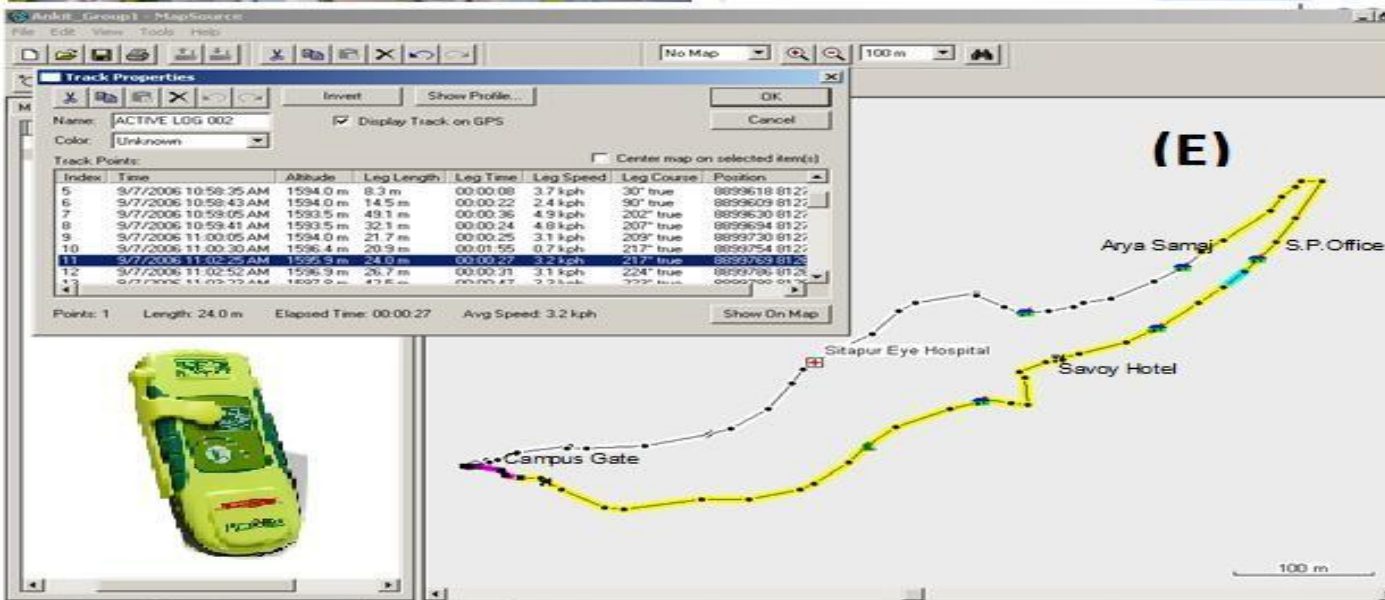
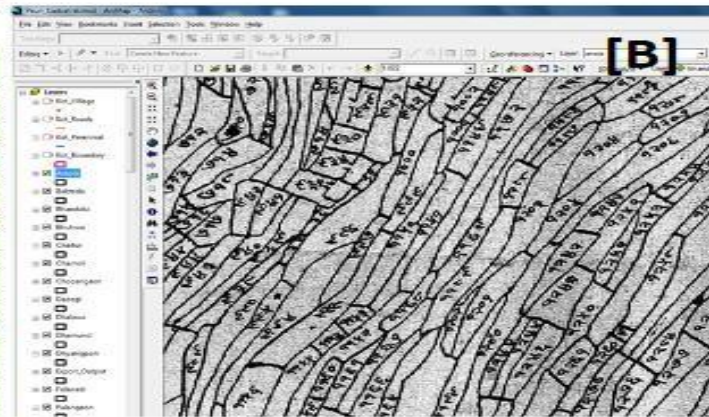
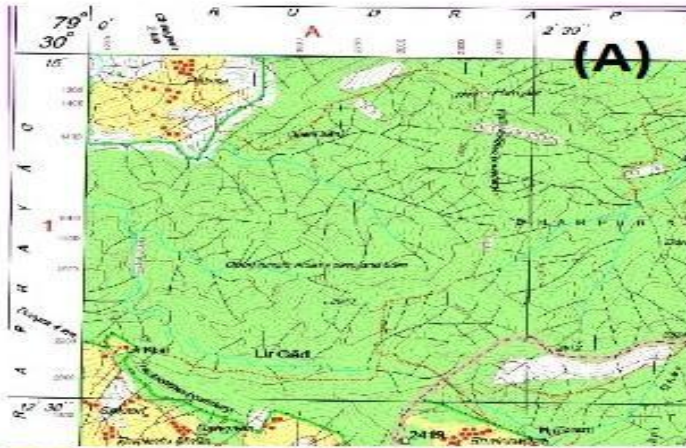
-

## ***Topographic Maps***

Topographic map depicting terrain relief and features. Scanned Topo sheet is used in the form of digital data for spatial data generation.

## ***Cadastral Maps***

A map showing the boundaries of the subdivisions of land for purposes of describing and recording ownership or taxation .



**Day First, 14<sup>th</sup> December, 2023**

**11:45am -1:30 pm**

## **2.0 GIS Data Inputs Technologies**

**2.1. Topographic Maps,**

**2.2 Cadastral Maps,**

**2.3 Aerial Photography,**

**2.4. Satellite Remote Sensing,**

**2.5 GPS/DGPS,**

**2.6 Drone,**

# **AERIAL PHOTOGRAPHS**

**Aerial photography is the taking of photographs of the ground from an elevated position, commonly captured from an aircraft. Digital photogrammetric systems use digitized photographs or digital images as the primary source of input. Digital imagery can be obtained from various sources.**

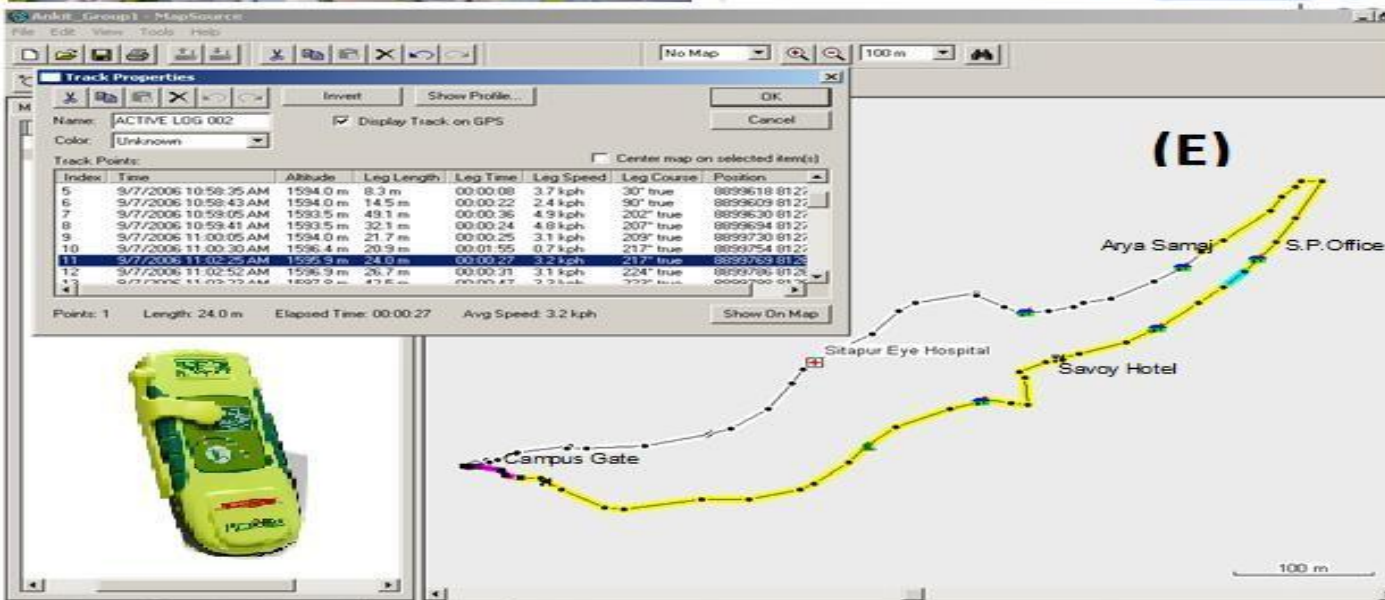
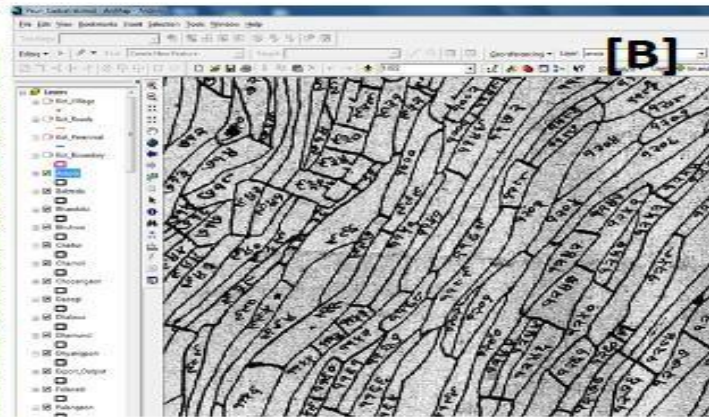
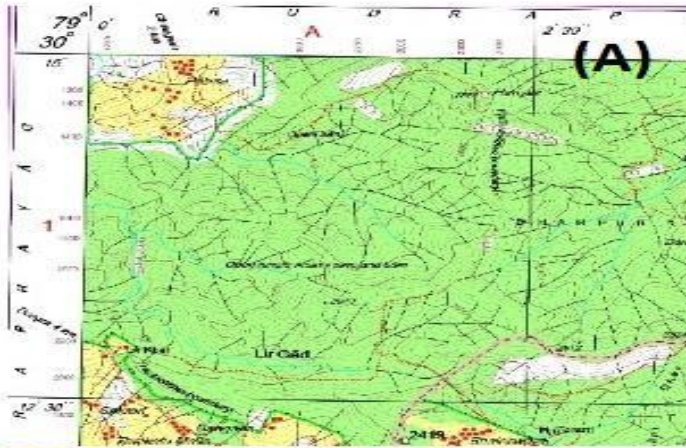
# AERIAL PHOTOGRAPHS



(a)



(b)



**Day First, 14<sup>th</sup> December, 2023**

**11:45am -1:30 pm**

## **2.0 GIS Data Inputs Technologies**

**2.1. Topographic Maps,**

**2.2 Cadastral Maps,**

**2.3 Aerial Photography,**

**2.4. Satellite Remote Sensing,**

**2.5 GPS/DGPS,**

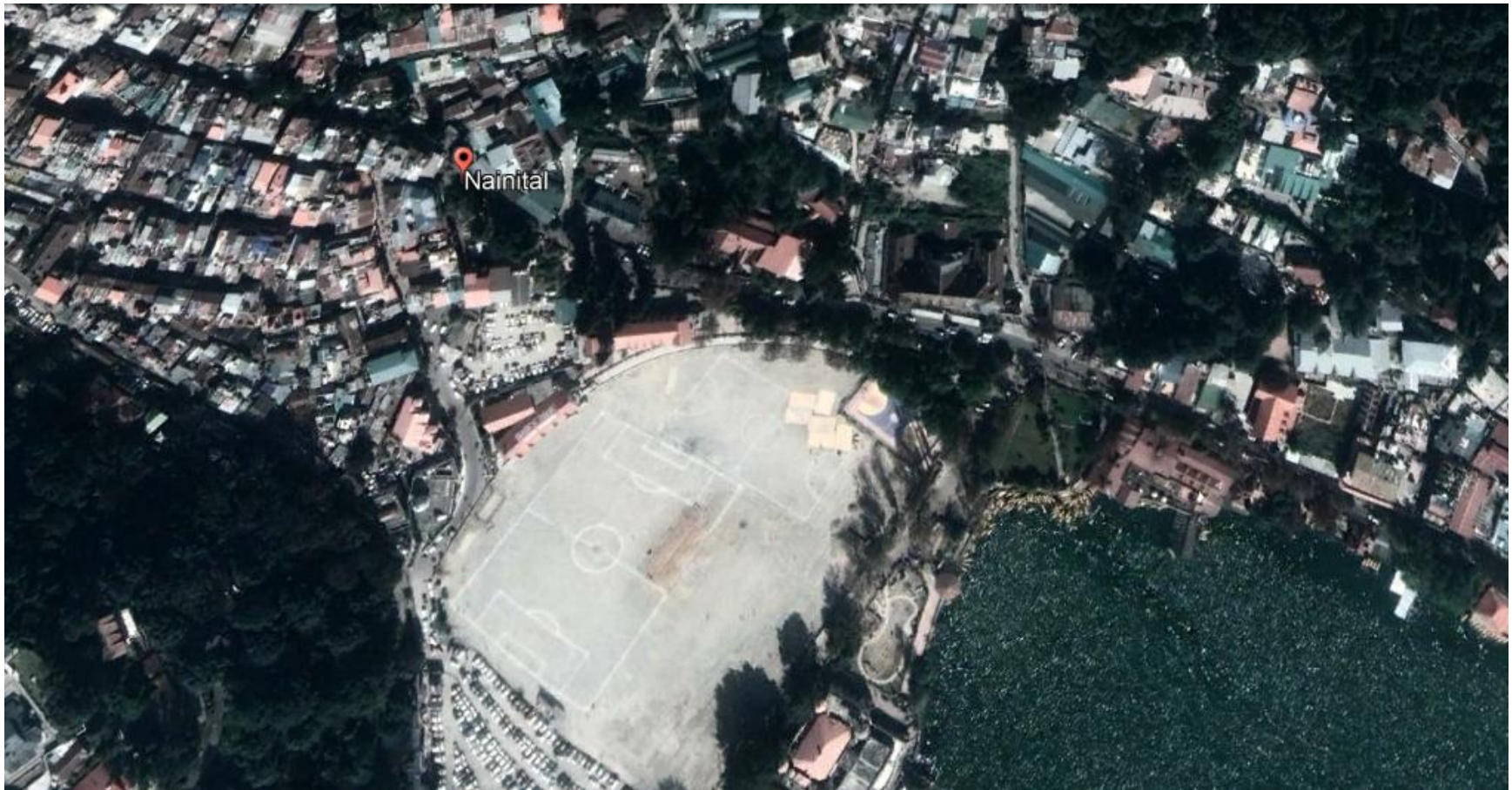
**2.6 Drone,**

# SATELLITE IMAGES

Satellite imagery consists of photographs of Earth made by means of satellites. These images are the important source in geospatial world. These Images are very important for raster analysis and to vector data generation.

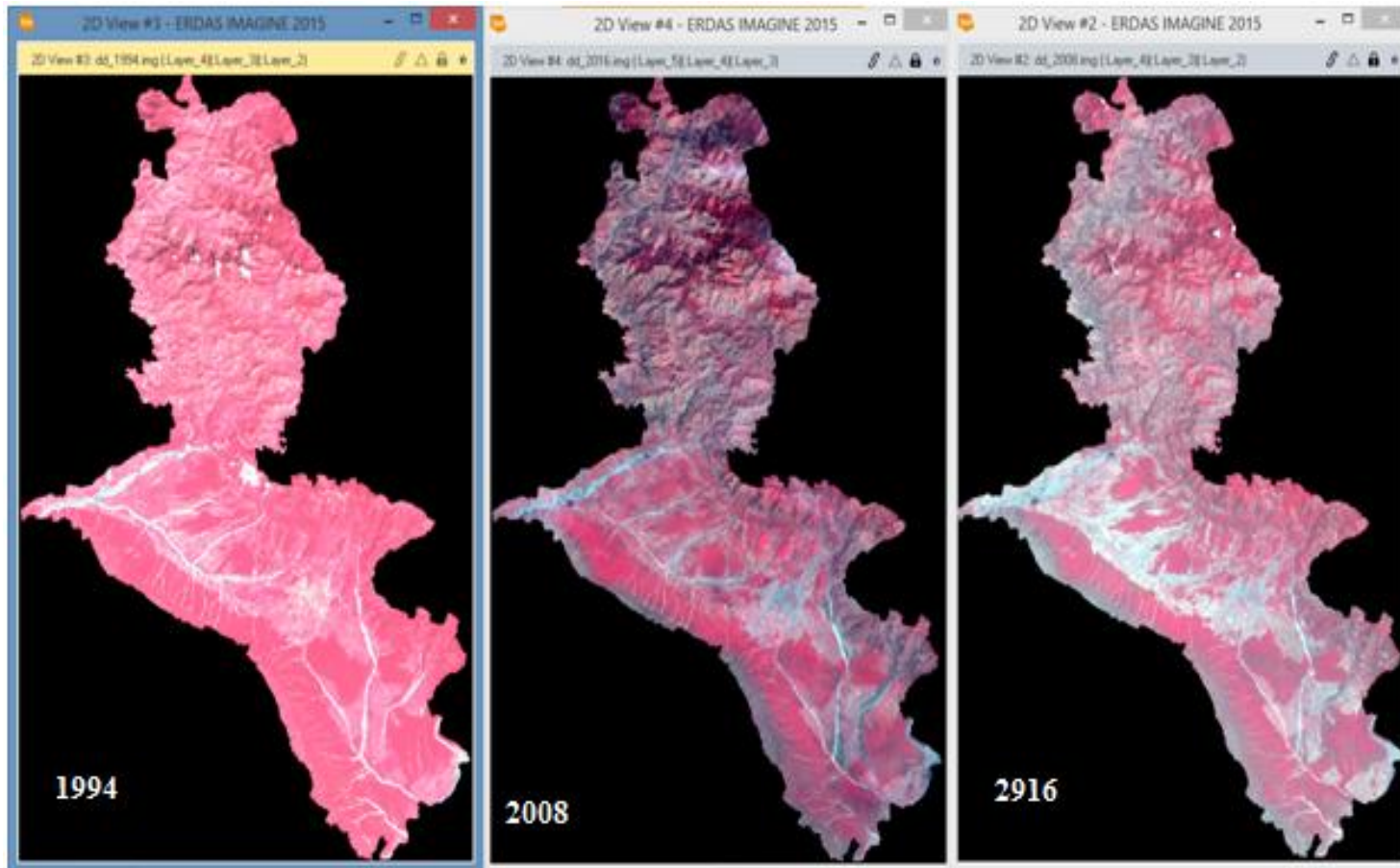
# SATELLITE IMAGE

## Nainital Flat Area



# SATELLITE IMAGES-LISS DATA

## District Dehradun



**Day First, 14<sup>th</sup> December, 2023**

**11:45am -1:30 pm**

## **2.0 GIS Data Inputs Technologies**

**2.1. Topographic Maps,**

**2.2 Cadastral Maps,**

**2.3 Aerial Photography,**

**2.4. Satellite Remote Sensing,**

**2.5 GPS/DGPS,**

**2.6 Drone.**

# **GPS AND DGPS**

**Traditional methods of surveying and navigation needs, field work and astronomical observations for positional and directional information, which is time consuming and tedious work. Diverse field conditions, seasonal variation and many unavoidable circumstances always bias the traditional field approach. However, due to rapid advancement in space technology, field of surveying and navigation is tremendously benefited through this technology**

# **GPS AND DGPS**

**These are also an important source of data input in GIS in this technology world, which collect with the help of GPS instrument and get processed in GIS based software**

IN/OUT Zoom kev

Menu/  
Find



Quit/Back key

Thumb Stick

Power/  
Backlight key

Cursor showing  
GPS Position

Map display

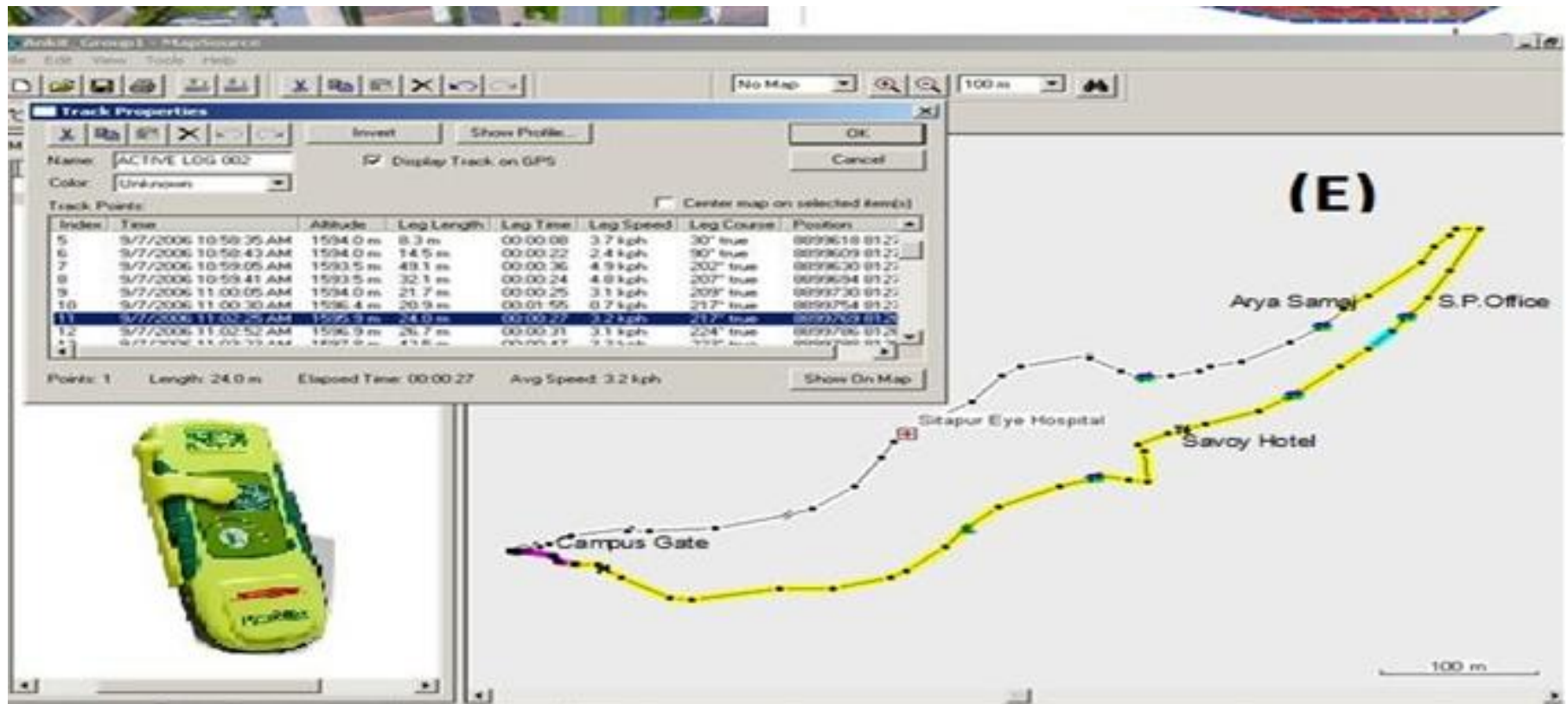
GPS



PDA



# Mobile Mapping by GPS





**Day First, 14<sup>th</sup> December, 2023**

**11:45am -1:30 pm**

## **2.0 GIS Data Inputs Technologies**

**2.1. Topographic Maps,**

**2.2 Cadastral Maps,**

**2.3 Aerial Photography,**

**2.4. Satellite Remote Sensing,**

**2.5 GPS/DGPS,**

**2.6 Drone.**

# **DRONE**

## **Unmanned Air Vehicle**

### **(UAV)**

**Drones images are the important source in geospatial world. These images are very important for high resolution raster analysis and to vector data generation.**

**DRONE**  
**Unmanned Air Vehicle**  
**(UAV)**



# DRONE IMAGE OF HONK KONG



**DRONE**  
**Unmanned Air Vehicle**  
**(UAV)**

**A Drone is a small or medium-sized unmanned aerial vehicle (UAV) that can fly autonomously or be remotely controlled. Drones are flying robots that can capture images and data from a high vantage point. They can be used for a variety of tasks, including military operations, package delivery, and agriculture**

# APPLICATION IN AGRICULTURE

- Precision Farming:
  - Crop Monitoring:
  - Weed and Pest Control
- Drones for Pest Surveillance:
  - Planning and Seeding
- Automated Fertilizer Applicators:
- Data Analysis and Decision Support
  - Livestock Monitoring
  - Environmental Monitoring
  - Drones for Soil Analysis

**Let us join hands together to bring  
g-Governance in Uttarakhand State for  
transparent, good and decentralised  
governance...**

**For any Technical Assistance for GIS  
Development Please feel free to contact:  
[jsrawat1955@gmail.com](mailto:jsrawat1955@gmail.com)**

**07533983533**

**THANK YOU**