

# **MAJOR COMPONENTS OF GIS**

**(T2\_LEC-2)**

***Dr. Supriya***

***Guest Assistant Professor***

***Department of Geography***

***Patna University, Patna***



# CONTENTS

- ✓ **Major Components of GIS**
- ✓ **Hardware Component**
- ✓ **Software Component**
  - ✓ **Data ware**
  - ✓ **Procedures**
  - ✓ **Live ware**
- ✓ **Model question**
- ✓ **References**

**Learning Objective: To understand different elements or components of GIS in detail.**

**Learning Outcome: Get familiarized with different components dealt in GIS**

# GIS & ITS COMPONENTS

*GIS is made up from several inter-related And linked components with different functions*

## COMPONENTS OF GIS

**HARDWARE**

**SOFTWARE**

**DATAWARE**

**PROCEDURES**

**LIVEWARE**

### *FUNCTION OF GIS*

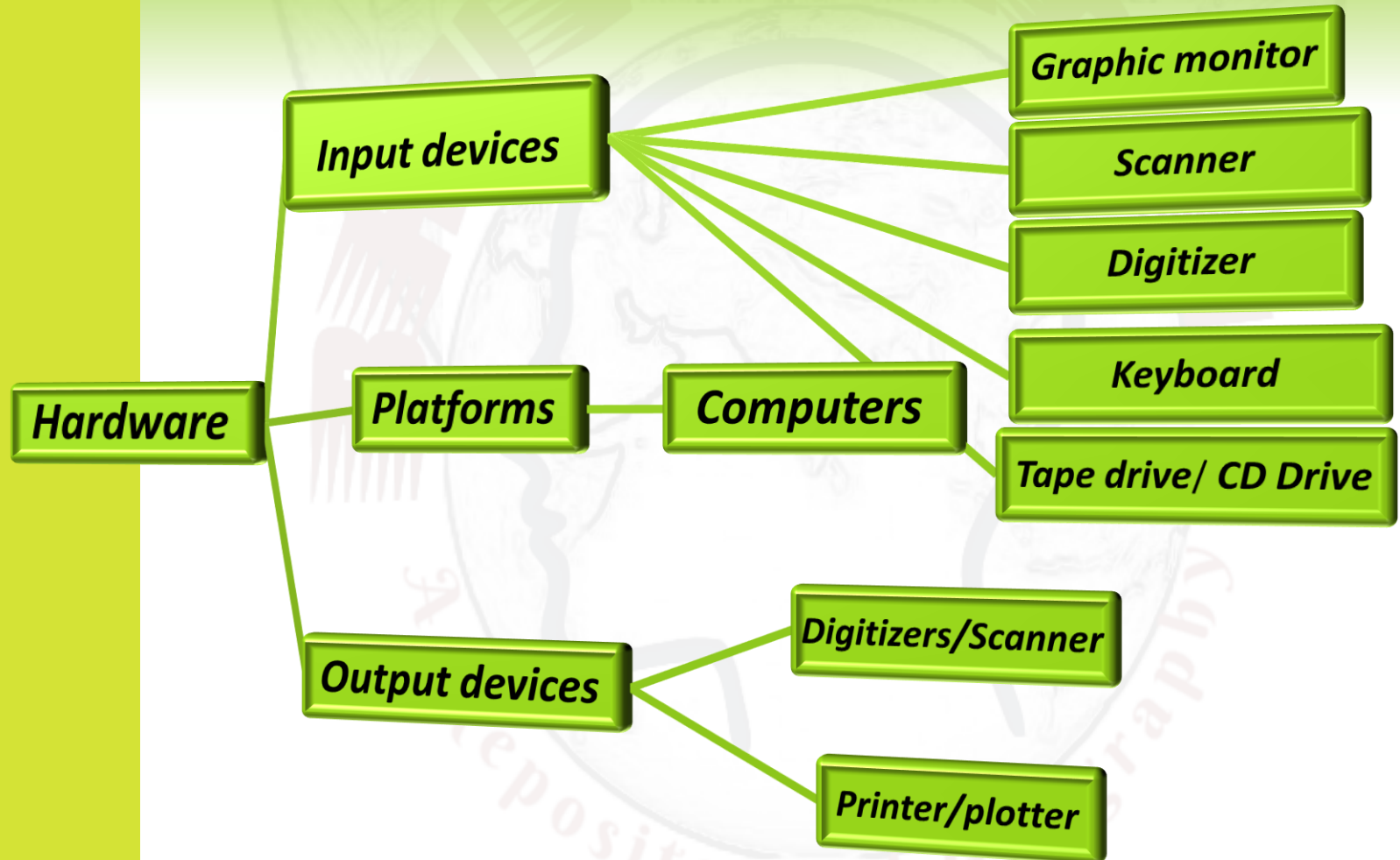
*Data Acquisition and Testing*  
*Data Storing and Management*  
*Data Retrieval & Representation*  
*Data Transformation*  
*Interaction with Users*

# 1. *HARDWARE*

## *HARDWARE*

- ⊙ Computer hardware is a system on which the GIS software runs.
- ⊙ Computer hardware is used to obtain inputs, processing, outputs and storage data.

# HARDWARE COMPONENT



# HARDWARE COMPONENT...

## *INPUT DEVICES*

- ① **Graphic monitors: display data, chart, GIS layers, enables processes etc.**
- ① **Scanner: convert map, data into digital format**
- ① **Digitizer: convert images into vector layers**
- ① **Keyboard: provides inputting functions or commands**
- ① **Tape drive/ CD drive: storing data, maps or softwares**

# HARDWARE COMPONENT...

**Graphic monitor**

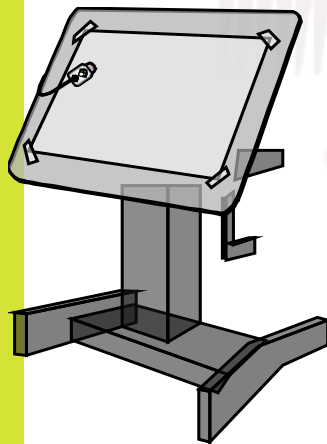


## INPUT DEVICES

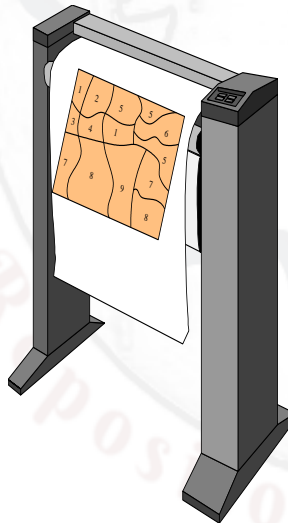
**Keyboard**



**Digitizer**



**Scanner**



**Tape drive**

**CD Drive**



# HARDWARE COMPONENT...

***PLATFORMS***

**COMPUTERS/ PCS/ LAPTOPS**

**PCS TO MULTI USER SUPER COMPUTERS**

**HARD DISK**

**FOR**

**STORING DATA AND SOFTWARES**



# HARDWARE COMPONENT...

*laptop*



*workstation*



## COMPUTERS/ PCS/ LAPTOPS

Tech Cycles Tend to Last Ten Years  
Entered Next Major Computing Cycle – Mobile Internet – 2 Years Ago

*Mainframe  
Computing  
1960s*



*Mini  
Computing  
1970s*



*Personal  
Computing  
1980s*



*Desktop Internet  
Computing  
1990s*



*Mobile Internet  
Computing  
2000s*



# HARDWARE COMPONENT...

## OUTPUT DEVICES

### ◎ Plotter

Plot the result of Map Design



### ◎ Printer

present the result on hard copy



# SOFTWARE COMPONENT

## *SOFTWARE*

- ◎ GIS software provides the functions and tools that are necessary to store, process, analyze, modeling and display of Geospatial data.
- ◎ Software's are classified by its capability:
  - Input Module
  - Editing Module
  - Modeling Module
  - Analysis Module

# SOFTWARE COMPONENT

## *GIS SOFTWARES*

- ARC INFO
- Arc View 3X
- MapInfo
- MGE
- Geo media
- Geo concept
- Geo mattica
- WINGIS
- Micro station
- AutoCAD
- QGIS

## *IMAGE PROCESSING*

- ERDAS
- ER Mapper
- ILWIS
- ENVI
- PCI
- Arc View image analysis
- TNTMIPS
- Ecognition

# *GIS SOFTWARES*

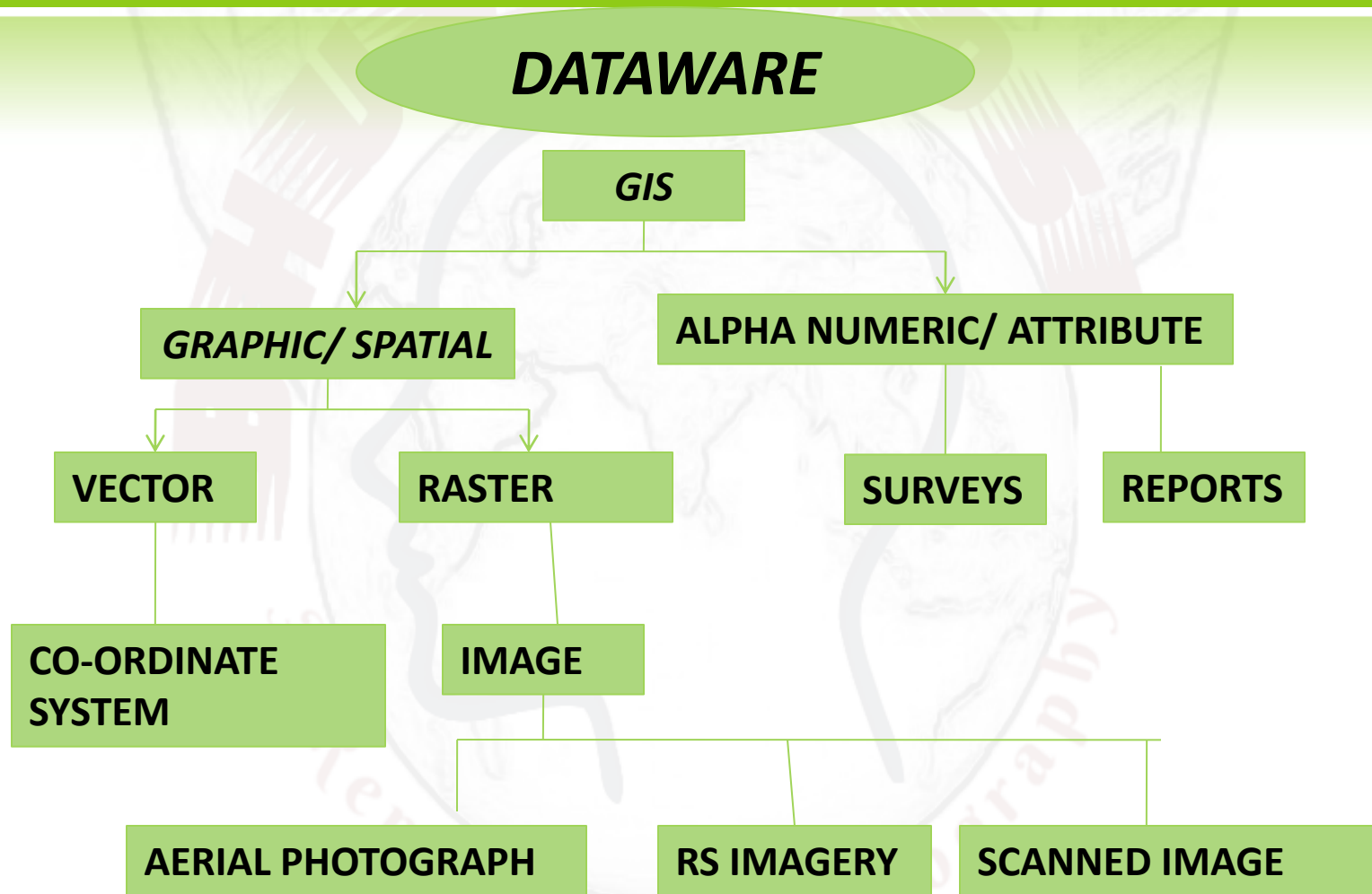
- **Autodesk** – Products include Map 3D, Topobase, **MapGuide** and other products that interface with its flagship AutoCAD software package.
- **Bentley Systems** – Products include Bentley Map, Bentley PowerMap and other products that interface with its flagship **MicroStation** software package.
- **Intergraph** – Products include **GeoMedia**, **GeoMedia Professional**, **GeoMedia WebMap**, and add-on products for industry sectors, as well as **photogrammetry**.
- **ESRI** – Products include **ArcView 3.x**, **ArcGIS**, **ArcSDE**, **ArcIMS**, **ArcWeb** services and **ArcGIS Server**.
- **ENVI**. Utilized for image analysis, exploitation, and hyperspectral analysis.
- **IDRISI** – GIS product developed by Clark Labs, a part of Clark University. Economical but capable, it is used for both operations and education.
- **MapInfo** by Pitney Bowes – Products include **MapInfo Professional** and **MapXtreme**. integrates GIS software, data and services.
- **Manifold System** – GIS software package.
- **Smallworld** – developed in Cambridge, England (Smallworld, Inc.) and purchased by **General Electric** and used primarily by **public utilities**.
- **QGIS** (previously known as **Quantum GIS**) is a **free** and **open-source cross-platform** desktop **geographic information system** (GIS) application that supports viewing, editing, and analysis of geospatial data



# GIS Processes in Different Software's

	AUTOCAD MAP	MAPINFO	ARCVIEW	ARC GIS	ERDAS	GOOGLE EARTH
<u>1</u>	Rubber sheeting	Geo referencing	Geo referencing	Geo referencing	Geo referencig	Geo referencing
<u>2</u>	.dwg	.tab	.shp	.shp	.img, .cov, .shp	.kml, .kmz
<u>3</u>	Feature creation: point, line polygon in one layer	Point, line, polygon feature created in one layer	Feature created in seprate layer	Feature created in separate layer	Feature created in separate layer	Feature created in separate layer
<u>4</u>	Drawing cleanup	-	-	-	Drawing cleanup	-
<u>5</u>	Topology (relation between features)	-	-	Topology	-	-
<u>6</u>	Data management	Data management	Data management	Data management	Data management	Data management
<u>7</u>	Query & Analysis	Query & Analysis	Query & Analysis	Query & Analysis	Query & Analysis	-
<u>8</u>	Layout	Layout	Layout	Layout	Layout	Layout
<u>9</u>	Raster image band change	-	-	Raster image band change	Classification	-
<u>10</u>	-	-	-	-	Mosaic	-
<u>11</u>	-	-	-	-	Subset	-
<u>12</u>	Clipping in overlay	-	-	Clipping	Clipping	-

# 2. DATAWARE COMPONENT

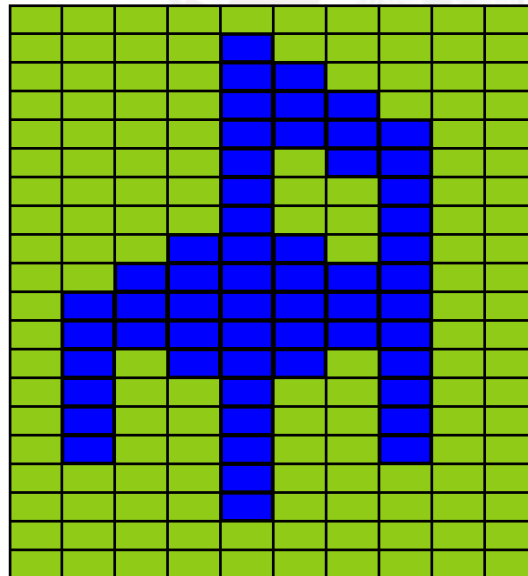


# DATA WARE COMPONENT...

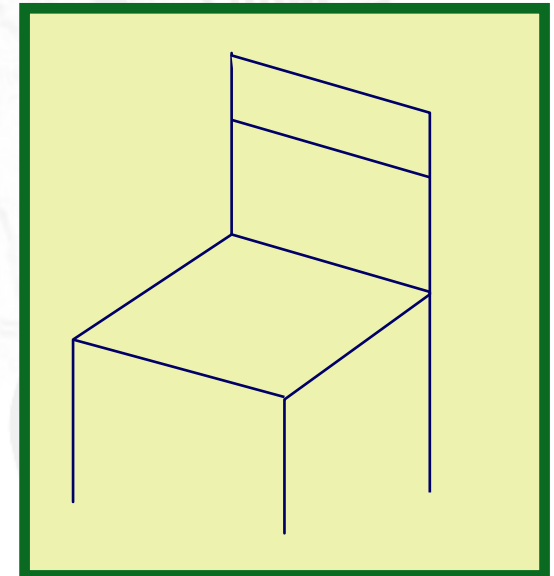
## ***SPATIAL DATA***

**RASTER**

**VECTOR**



**RASTER MODEL**



**VECTOR MODEL**



# DATA WARE COMPONENT...

## *ATTRIBUTE DATA*

- ③ Attributes can be numeric or alphanumeric data that is assigned to a point, line or area spatial features
- ③ Example Attributes...  
Stand ID, Compartment no, Vegetation type, Name of the Forest Block, Type of Road, VSS code etc.,

# DATA WARE COMPONENT...

## THE DATABASE

- Provides for the input, storage, and retrieval of data
- A database is the set of data that are stored.
- Database Management System (DBMS) – is a collection of software for storing, editing and retrieving data in a database.

The image shows three overlapping screenshots of data tables. The first is 'Attributes of Rdline', the second is 'Attributes of Airport.shp', and the third is 'table2.txt - Notepad'.

Length	Rdline#	Rdline-id	Rdlinetype	Rdlin
0.003	1	536	2	
0.050	2	536	2	
0.032	3	573	2	
0.035	4	289	2	
0.082	5	289	2	
0.062	6	289	2	
0.023	7	538	2	
0.048	8	539	1	
0.032	9	117	2	
0.052	10	117	2	
0.250	11	287	2	
0.070	12	116	2	

Shape	Name	Country	A
Point	PITT MEADOWS	CA	BRITISH COL
Point	VANCOUVER INTL	CA	BRITISH COL
Point	BOUNDARY BAY	CA	BRITISH COL
Point	BELLINGHAM INTL	US	WASHINGTON
Point	ROCHE HARBOR	US	WASHINGTON
Point	POWELL RIVER	CA	BRITISH COL
Point	COMOX	CA	BRITISH COL
Point	TEXADA	CA	BRITISH COL
Point	PRINCETON	CA	BRITISH COL
Point	CHILLIWACK	CA	BRITISH COL
Point	NANAIMO	CA	BRITISH COL
Point	ABDICEFORD	CA	BRITISH COL

```
"Popyreg", "Popycoun", "Popyadmin", "X-coord", "Y-coord"  
N, CA, BRITISH COLUMBIA, 598110.00000, 5485050.00000  
5, 00, , 485374.06250, 5373037.00000  
N, CA, BRITISH COLUMBIA, 362882.12500, 5538235.75000  
N, CA, BRITISH COLUMBIA, 403992.84375, 5525419.25000  
5, 00, , 379086.18788, 5538058.75000  
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N, CA, BRITISH COLUMBIA, 381337.18750, 5524611.75000  
N, CA, BRITISH COLUMBIA, 416700.35938, 5434016.25000  
N, CA, BRITISH COLUMBIA, 400327.21875, 5499948.00000  
N, CA, BRITISH COLUMBIA, 429264.20313, 5515108.75000
```

# 3. PROCEDURES

## *PROCESSES*

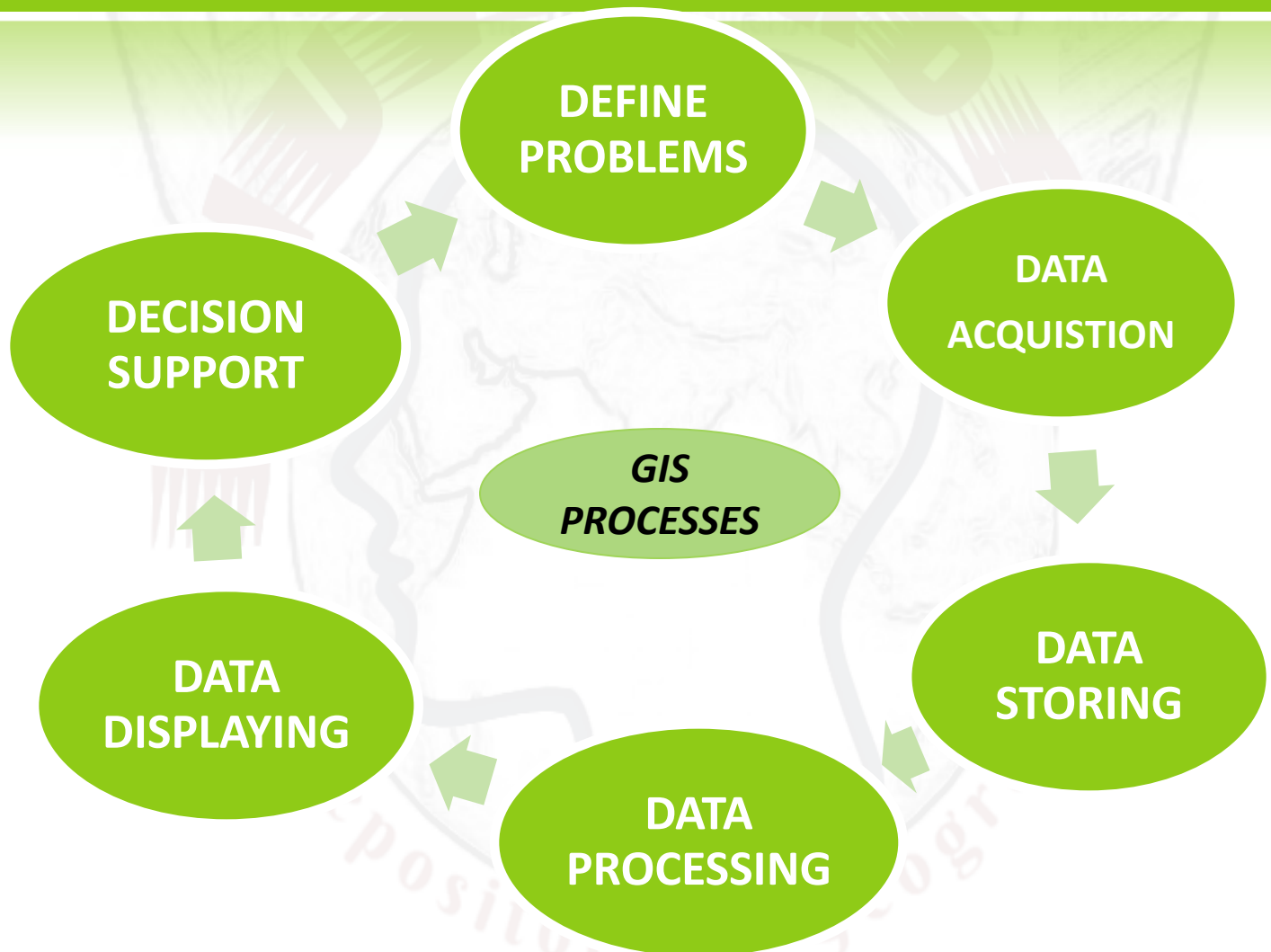
**A COMPUTER SYSTEM FOR GIS CONSISTS**

**OF**

**HARDWARE, SOFTWARE AND PROCEDURES  
DESIGNED TO SUPPORT**

**DATA CAPTURING, STORING, PROCESSING,  
ANALYSING, MODELLING AND DISPLAYING  
GEOSPATIAL DATA**

# PROCEDURES COMPONENT...



# PROCEDURES...

- ① GIS is Set of Process:-
- ① DEFINE PROBLEMS (Flood Devastation in Bihar)
- ① DATA ACQUISITION ( Through Satellites RADARSAT & weather monitoring Stations)
- ① DATA STORING (FMIS introduced in 2006 by Government Initiative)
- ① DATA PROCESSING (areal extent of flood water spread.
- ① DATA DISPLAYING (The inundation extent is derived from RADARSAT Layers/Imagery provided by NRSC )
- ① DECISION SUPPORT: E: Bulletin

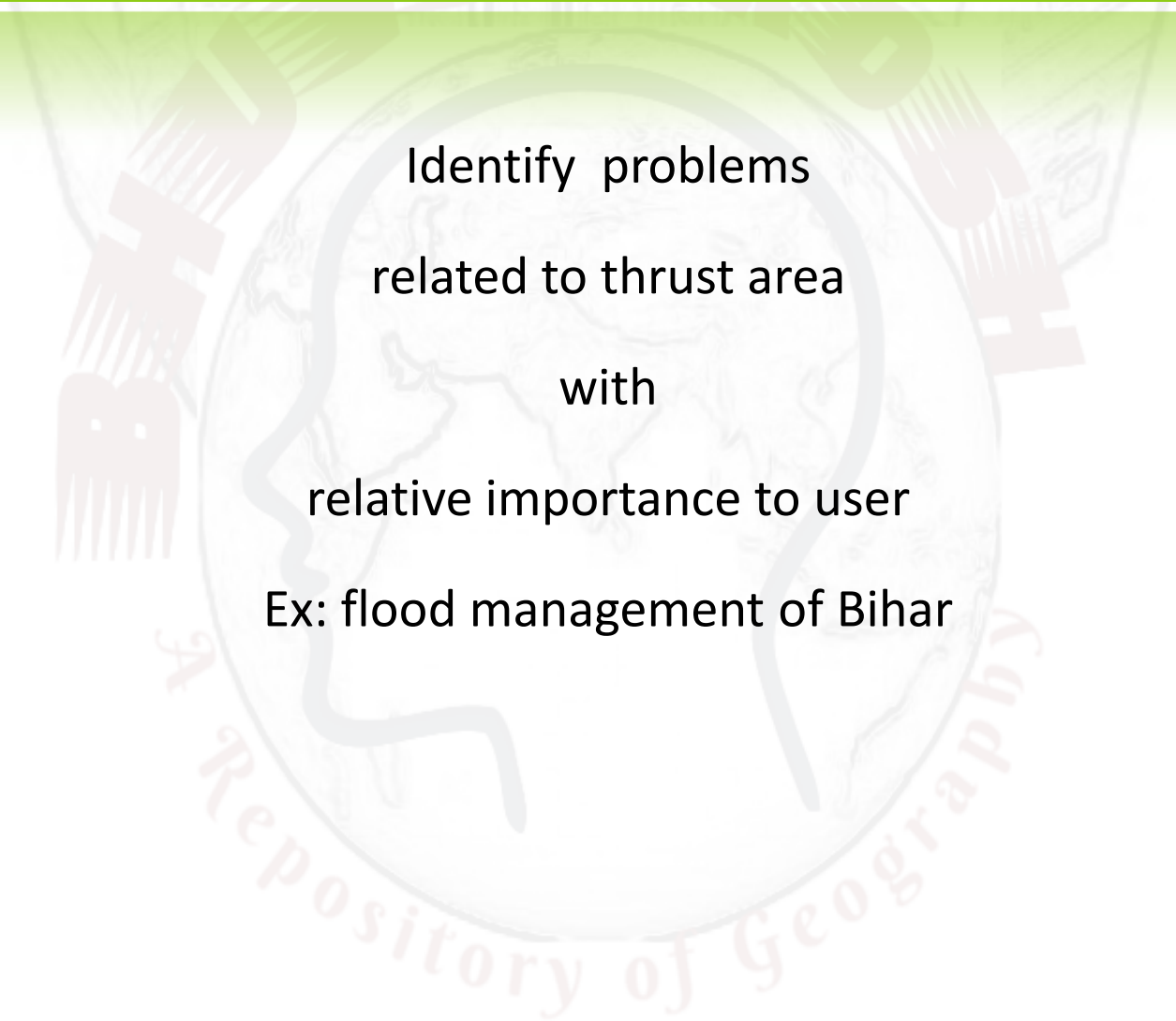
# DEFINE PROBLEMS

Identify problems  
related to thrust area

with

relative importance to user

Ex: flood management of Bihar



# DATA ACQUISITION

**It covers all aspect  
of  
capturing data from  
existing maps, raster images and field survey  
converting into digital form  
(MS office Excel 97\_2003,MS Access, Oracle,  
SQL Server, Micro Station )**

# DATA STORING

**Data stored into computer system**

**in different forms**

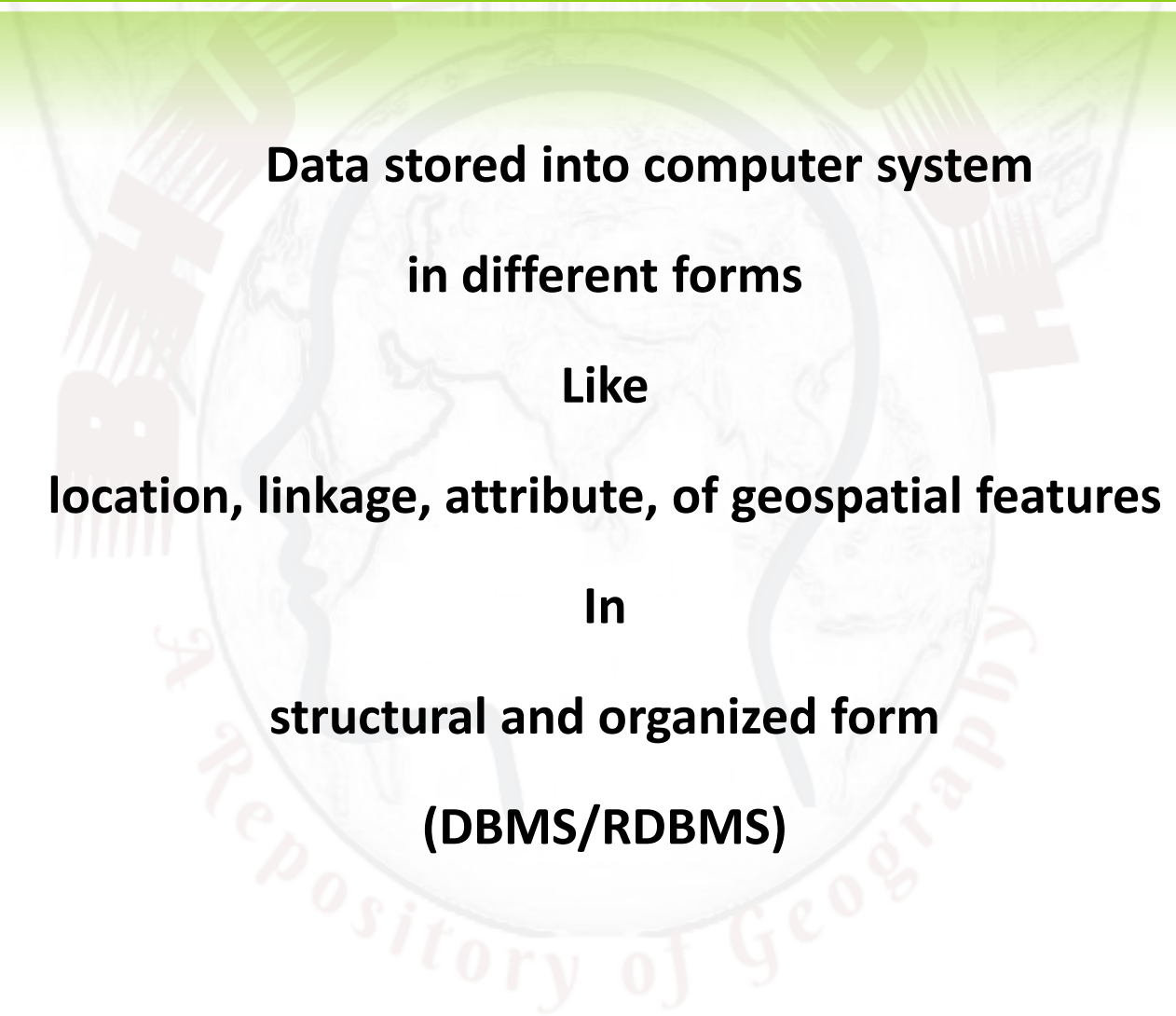
**Like**

**location, linkage, attribute, of geospatial features**

**In**

**structural and organized form**

**(DBMS/RDBMS)**





# DATA PROCESSING

**Transformation, updating, analyzing methods applied to data to answer queries to GIS**

**Classification, Queries, Area Calculation, Address matching, Overlay, Network, Proximity, Buffer, DTM, Simulation, Change Detection, Forecasting, Visibility etc are some Models incorporated with GIS**



# DATA DISPLAYING

**Data are represented**

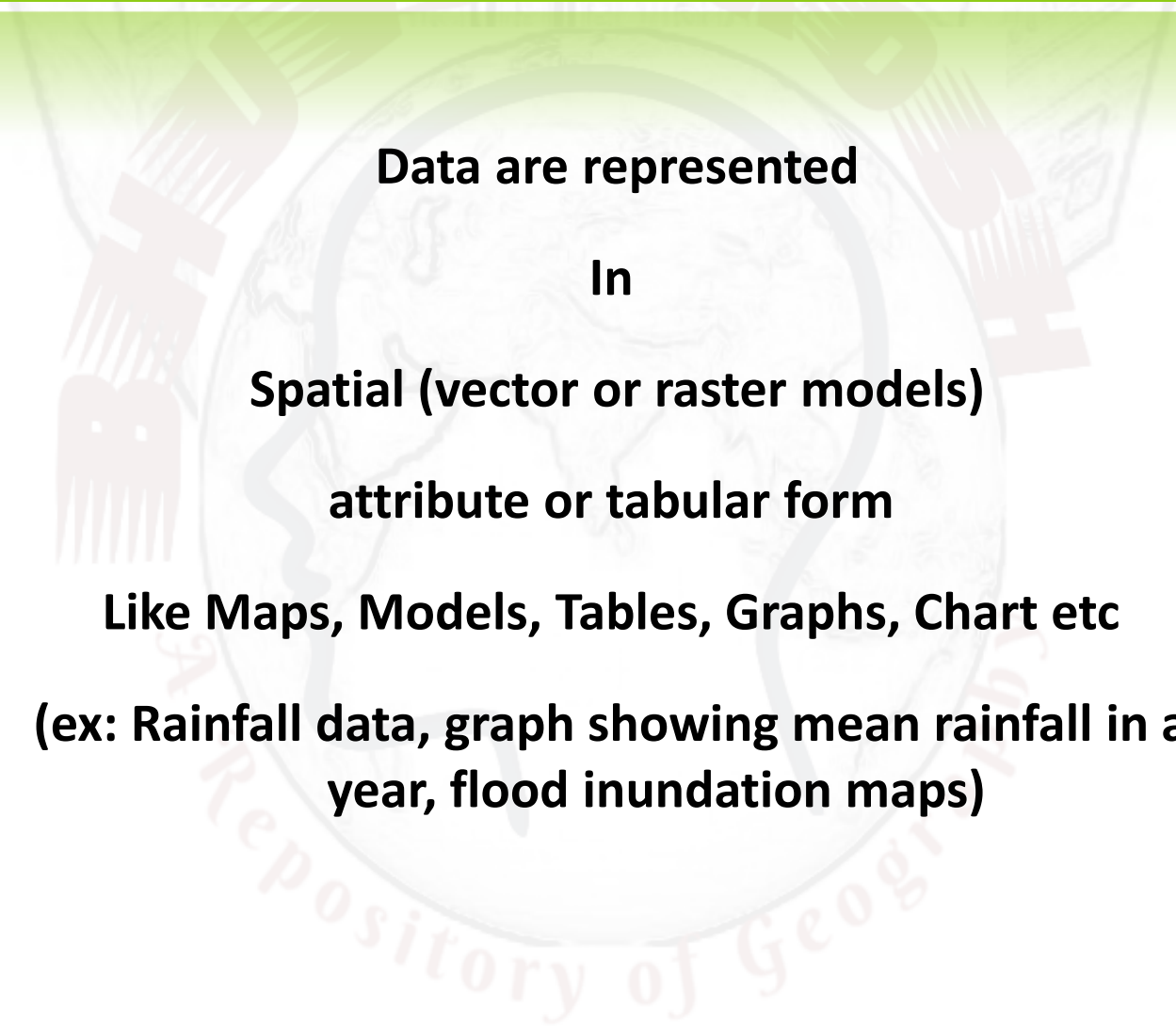
**In**

**Spatial (vector or raster models)**

**attribute or tabular form**

**Like Maps, Models, Tables, Graphs, Chart etc**

**(ex: Rainfall data, graph showing mean rainfall in a year, flood inundation maps)**



# DECISION SUPPORT

**GIS outputs  
are  
used in efficient planning for relevant issues  
and  
made a decision support system for all  
(ex: FMIS is a GIS based decision support system for  
efficient management of flood control in Bihar  
for every level)**

# 5. LIVEWARE

## LIVEWARE

- ◎ **LIVEWARE : no GIS can exists in isolation of the technicians & the users;**
  - ◎ **Technicians: people behind the plan, implementation and operate the system as well as made decision based on the out put.**
  - ◎ **Users: people who select pertinent information to set necessary standards to design –cost – efficient GIS outputs for relevant purpose.**

# MODEL QUESTIONS

## Long type Questions:

**Q1. List the main components of GIS. Write short notes on them.**

**Q2. Discuss briefly “Hardware” as one component of GIS.**

**Q3. Discuss briefly “Software” as one component of GIS.**

**Q4. Discuss briefly Data “Information” as one component of GIS.**

**Q5. Discuss briefly “People” as one component of GIS.**

## Short type questions:

**Q1. Write notes on different platform.**

**Q2. Write Short Notes on them**

**a. Input & Output devices      c. Hardware and Software**

**b. Users & technicians          d. Process in GIS**

**Assignment: 1. Explain briefly major components of GIS through flow chart and illustrations.**

# SUGGESTED READINGS

- Albert , C.P.Lo. & Yeung. K.W., (2007) Concept and techniques of Geographic information system ; PHI Learning PVT Ltd. New Delhi
- Burrough,P.A. and McDonnell, R.A., (1998) : Principles of Geographic Information Systems, Oxford University Press, Oxford. De Mers, Michael N., (1999) : Fundamentals of Geographic Information Systems, John Wiley & Sons, NewYork.
- Fraser Taylor, D. R. (1991): Geographical Information System, London.
- DevidattChauniyal, Sudoor Samvedanevam Bhaugolik Soochna Pranali.
- Heywood, I. et al. (2004) : An Introduction to Geographic Information Systems, Pearson Education.
- Longley, P.A., Goodchild, M.F., Maguire, D.J. and Rhind, D.W., (2001), Geographic Information Systems and Science, Wiley, Chichester.
- Siddiqui, An Introduction to Geographical Information System.

**Contact me:**

**Mob/ WA: 9006640841**

**Emai:[supriyavatsa52256@gmail.com](mailto:supriyavatsa52256@gmail.com)**

**Webpage: <http://bhuvankosh.com>**