GIS Technologies and It's Applications

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A bit of History

- Maps… cartography
- Aerial Photography, Photogrammetry..II WW
- Satellites …
- Computers … Maps in Digital form
- Layer of Maps

Definition of GIS

What is GIS?

GIS = Geographic Information System

A GIS integrates hardware, software and data for **capturing**, **managing**, **analyzing**, and **displaying** all forms of geographically referenced information.

Activ
Go to

Various Technologies of GIS

- Remote Sensing/ Photogrammetry
- GPS
- Internet
- GPR
- LiDAR
- DBMS
- DATA CENTER TECHNOGIES

Technology Used in GIS

- Data Creation.
- Data Integration … Various sources .. Varios types
- Data Presentation.

Statistical Modelling in GIS

- Importance of Statistics
- Precautions
- Impact

Data Sources and Types

- Geo-Spatial Data …. Maps, RS Imagery, Photography from Air, Records etc.,

a. Raster Form …. Continuous… Grid cells .. RS Imagery or Photograph

b. Vector Form … Points, Lines and Polygons

Rastor vrs Vector

Attribute data… In records of agencies, government, from field etc.,

GIS Platforms

- Desktop.
- Server based GIS
- Web GIS
- Mobile GIS
- Distributed GIS.. Multi Locations

Data formats of GIS

- Raster Formats … Continuous.. No hard boundaries or locations jpeg, tiff, geotiff, LiDAR, Arcinfo grid etc.
- Vector formats … .shp , .sdc. .gdb format of ESRI .dgn of Bently, .dwg of Auto Cad etc.,
- Chose a popular one.

GIS Softwares

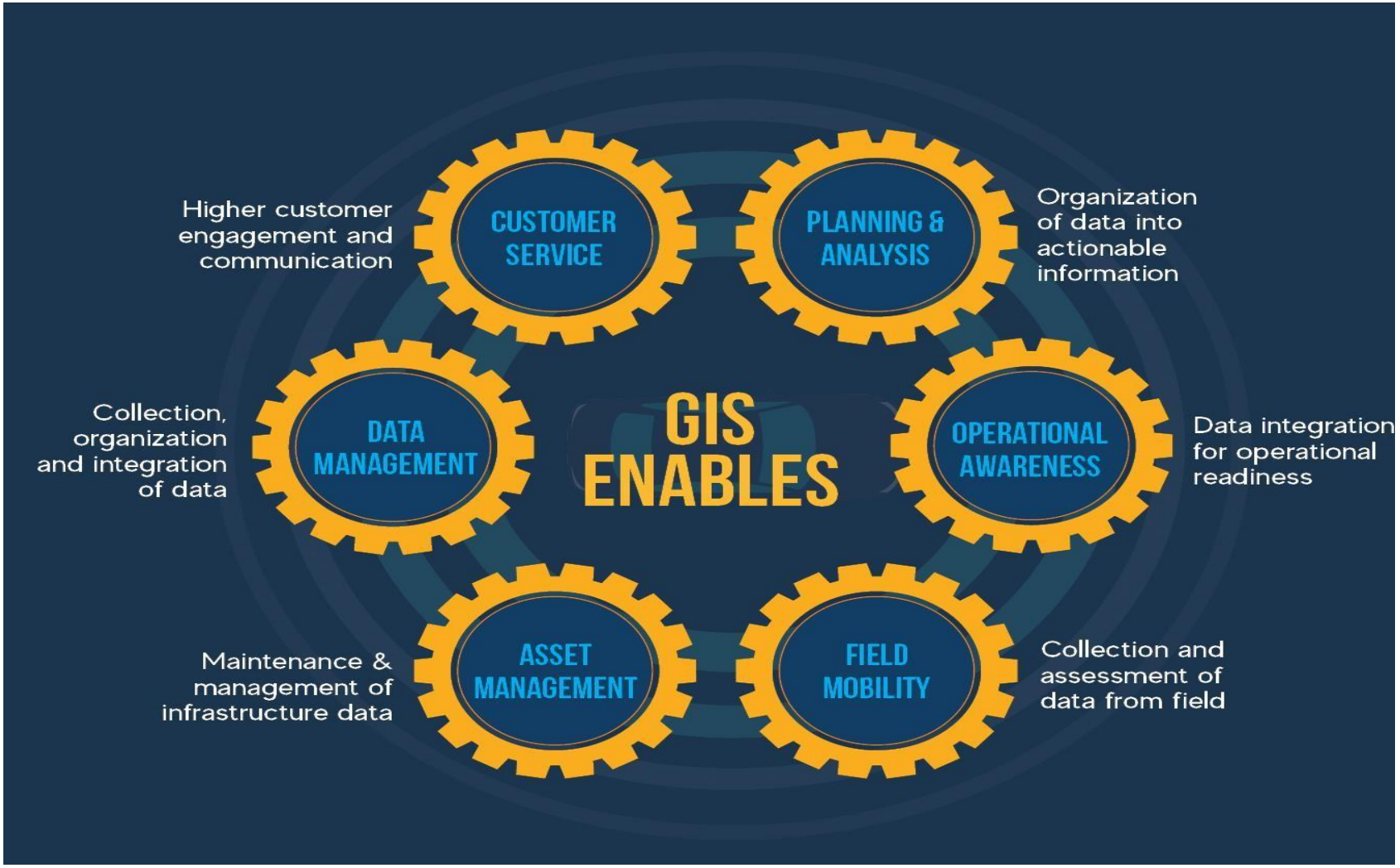
- Commercial Softwares:
- **Commercial or proprietary GIS software**
- Most widely used notable proprietary software applications and providers:
- ESRI – Products include ArcView 3.x, ArcGIS, ArcSDE, ArcIMS, and ArcWebservices.
- GRAM++ GIS – Low-cost GIS software product developed by CSRE, IIT Bombay.
- Autodesk – Products include MapGuide and other products that interface with its flagship AutoCAD software package.
- Cadcorp – Developers of GIS software and OpenGIS standard
- Intergraph – Products include GeoMedia, GeoMedia Profesional, GeoMedia WebMap
- ERDAS IMAGINE – A proprietary GIS, Remote Sensing, and Photogrammetry software developed by Leica Geosystems Geospatial Imaging.
- SuperGeo – Products include SuperGIS Desktop & extensions, SuperPad Suite, SuperWebGIS & extensions, SuperGIS Engine & extensions, SuperGIS Network Server and GIS services.
- SuperMap GIS – Products include SuperMap iServer .NET/Java, SuperMap Deskpro, SuperMap Objects, SuperMap Express, SuperMap IS .NET, eSuperMap, SuperNavigation Engine, FieldMapper and services.
- IDRISI – Proprietary GIS product developed by Clark Labs.
- MapInfo – Products include MapInfo Professional and MapXtreme. integrates GIS software, data and services.
- MapPoint – Proprietary GIS product developed by Microsoft.

Open Source GIS Softwares

- Most widely used open source softwares:
- GRASS – Originally developed by the U.S. Army Corps of Engineers, open source: acomplete GIS
- MapServer – Web-based mapping server, developed by the University of Minnesota.
- Chameleon – Environments for building applications with MapServer.
- GeoNetwork opensource – A catalog application to manage spatially referencedresources
- GeoTools – Open source GIS toolkit written in Java, using Open Geospatial Consortium
- specifications.
- gvSIG – Open source GIS written in Java.
- ILWIS – ILWIS (Integrated Land and Water Information System) integrates image,vector and thematic data.
- JUMP GIS – Java Unified Mapping Platform.
- MapWindow GIS – Free, open source GIS desktop application and programmingcomponent.
- OpenLayers – open source AJAX library for accessing geographic data layers of allkinds, originally developed and sponsored by MetaCarta
- PostGIS – Spatial extensions for the open source PostgreSQL database, allowinggeospatial queries.
- Quantum GIS – QGIS is a user friendly Open Source GIS that runs on Linux, Unix,Mac OSX, and Windows.
- TerraView – GIS desktop that handles vector and raster data stored in a relational or geo-relational database.

Other GIS Softwares

- **Other GIS software**
- AccuGlobe – Fully functional GIS and geoanalysis software platform for Windowsdeveloped by DDTI (ddti.net) and available free of charge, but not open source.
- CrossView for ArcGIS – created by A-Prime Software, CrossView is a wizard- basedArcGIS plug-in, which enables map cross-sectioning and profile creation.
  - GeoBase – Geospatial platform developed by Telogis. A particular focus is placed on
- real-time processing for reverse-geocoding, geofencing, etc.
  - LandSerf – Free GIS written in Java
  - My World GIS – Intuitive low-cost GIS platform for Windows and Mac OSX withrobust/intuitive geoprocessing tools, developed for educational.
  - Panorama – Russian GIS for military uses.
  - SPRING – GIS software developed at INPE –
- SavGIS – Free and complete GIS software available in French, English and Spanish
- MapTools – Suite of open-source GIS products and platforms.
- OpenStreetMap – Online map viewer, with map editing capability.


GIS ENABLES
CUSTOMER SERVICE
Higher customer engagement and communication
PLANNING & ANALYSIS
Organization of data into actionable information
DATA MANAGEMENT
Collection, organization and integration of data
OPERATIONAL AWARENESS
Data integration for operational readiness
ASSET MANAGEMENT
Maintenance & management of infrastructure data
FIELD MOBILITY
Collection and assessment of data from field

GIS Applications and Uses:

- ***GIS in Mapping:***
- Mapping is a central function of Geographic Information System, which provides a visual interpretation of data. GIS store data in database and then represent it visually in a mapped format. People from different professions use map to communicate. It is not necessary to be a skilled cartographer to create maps. Google map, Bing map, Yahoo mapare the best example for web based GIS mapping solution.
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Telecom and Network services:

- GIS can be a great planning and decision making tool for telecom industries. GDi GISDATA enables wireless telecommunication organizations to incorporate geographic data in to the complex network design, planning, optimization, maintenance and activities. This technology allows telecom to enhance a variety of application like engineering application, customer relationship management and location based services.
- ***Accident Analysis and Hot Spot Analysis:***
- GIS can be used as a key tool to minimize accident hazard on roads, the existing road network has to be optimized and also the road safety measures have to be improved. This can be achieved by proper traffic management. By identifying the accident locations, remedial measures can be planned by the district administrations to minimize the accidents in different parts of the world. Rerouting design is also very convenient using GIS.
- ***Urban Planning:***

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- GIS technology is used to analyze the urban growth and its direction of expansion, and to find suitable sites for further urban development. In order to identify the sites suitable for the urban growth, certain factors have to consider which is: land should have proper accessibility, land should be more or less flat, land should be vacant or having low usage value presently and it should have good supply of water.

- ***Transportation Planning:***

- GIS can be used in managing transportation and logistical problems. If transport department is planning for a new railway or a road route then this can be performed by adding environmental and topographical data into the GIS platform. This will easily output the best route for the transportation based on the criteria like flattest route, least damage to habitats and least disturbance from local people. GIS can also help in monitoring rail systems and road conditions.

- ***Environmental Impact Analysis:***

- EIA is an important policy initiative to conserve natural resources and environment. Many human activities produce potential adverse environmental effects which include the construction and operation of highways, rail roads, pipelines, airports, radioactive waste disposal and more. Environmental impact statements are usually required to contain specific information on the magnitude and characteristics of environmental impact. The EIA can be carried out efficiently by the help of GIS, by integrating various GIS layers, assessment of natural features can be performed.

- ***Agricultural Applications:***

- GIS can be used to create more effective and efficient farming techniques. It can also analyze soil data and to determine: what are the best crop to plant?, where and when they should be used etc.,

What GIS Applications Do:

manage, analyze, communicate

- make possible the **automation** of activities involving geographic data
  - map production
  - calculation of areas, distances, route lengths
  - measurement of slope, aspect, volumes
  - logistics: route planning, vehicle tracking, traffic management
- allow for the **integration** of data hitherto confined to independent domains (e.g property maps and air photos).
- by tying data to maps, permits the succinct **communication of complex spatial patterns** (e.g environmental sensitivity).
- provides answers to **spatial queries** (how many elderly in Richardson live further than 10 minutes at rush hour from ambulance service?)
- perform complex **spatial modelling** (*what if* scenarios for transportation planning, disaster planning, resource management, utility design)
- **Gives a Scientific Rationale based Decision Support System**

Maps and GIS

- Maps
- Web Mapping
- Maps in governance
- Maps in Business… Give me the profile of client and GIS gives you address
- Maps for Citizens

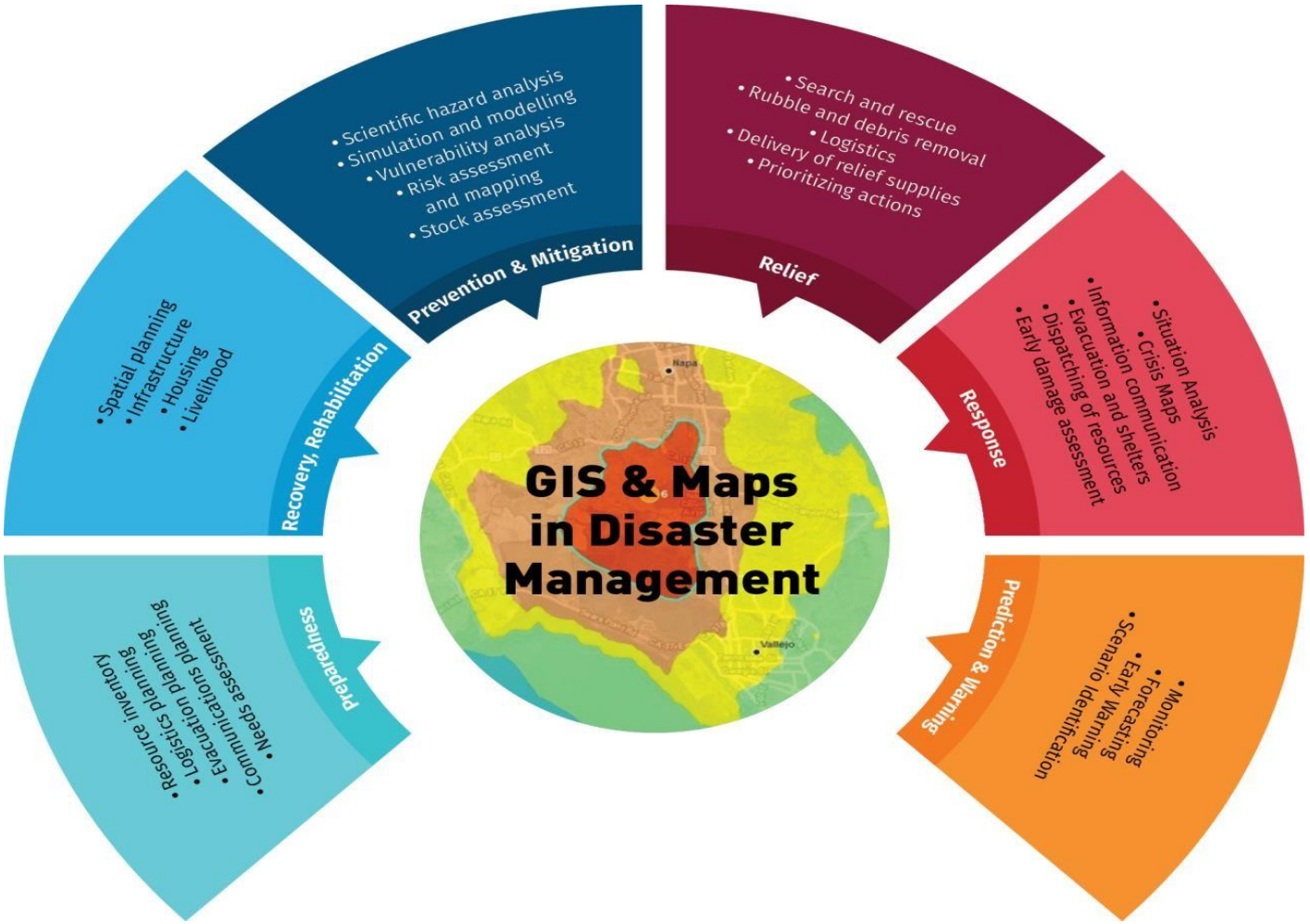
Maps in Disaster Management

- Floods. Urban floods, flash Floods Etc.,
- Earth Quakes
- Psunamis
- Vulconic eruptions.
- Civil Disturbances
- Fires

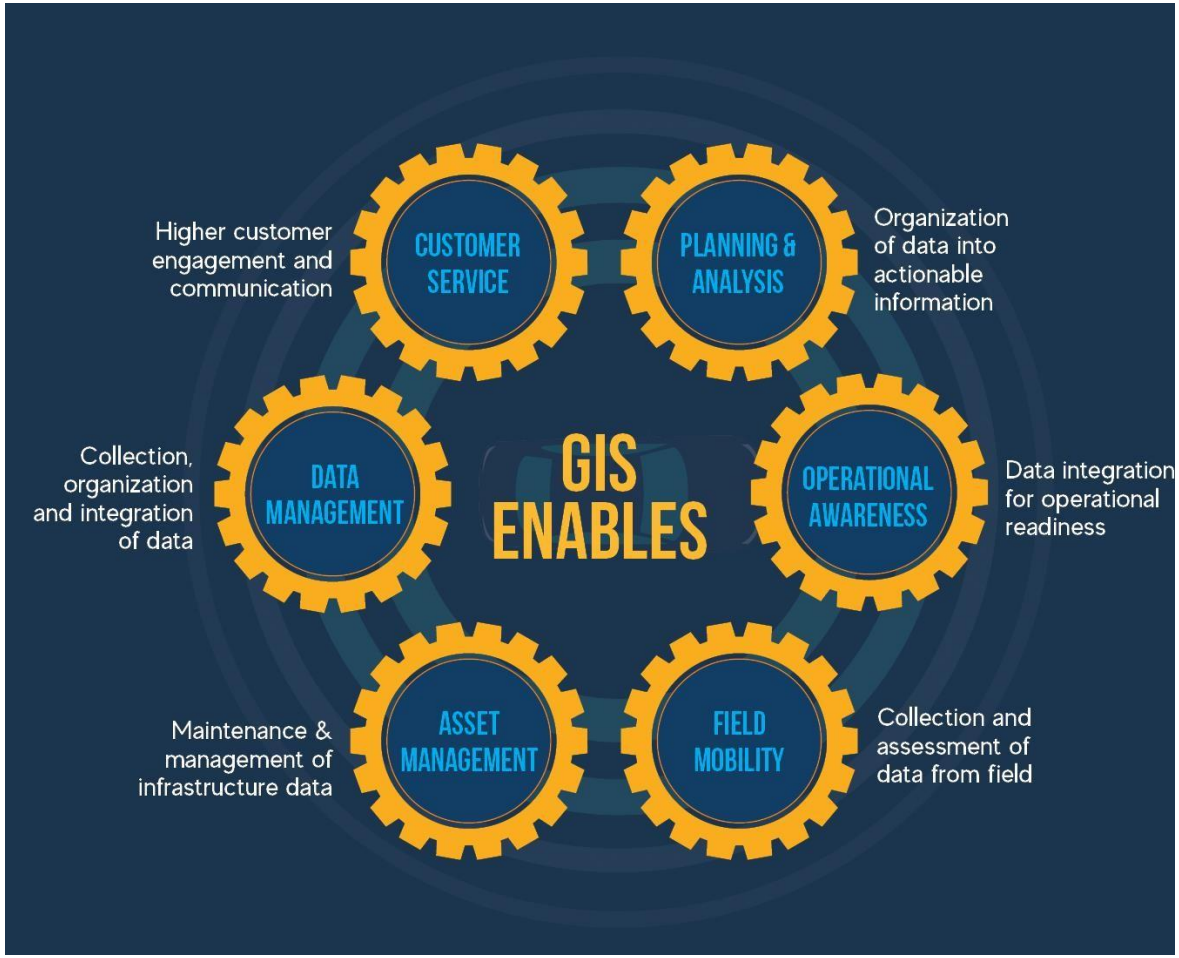
Maps

- Exploring Global Changes…UNGGIM Etc.,
- Agriculture
- Social Events

Maps and GIS


GIS & Maps in Disaster Management
Prevention & Mitigation
• Scientific hazard analysis
• Simulation and modelling
• Vulnerability analysis
• Risk assessment and mapping
• Stock assessment
Relief
• Search and rescue
• Rubble and debris removal
• Logistics
• Delivery of relief supplies
• Prioritizing actions
Response
• Situation Analysis
• Crisis Maps
• Information communication
• Evacuation and Shelters
• Dispatching of resources
• Early damage assessment
Prediction & Warning
• Monitoring
• Forecasting
• Early Warning
• Scenario Identification
Preparedness
• Resource inventory
• Logistics planning
• Evacuation planning
• Communications planning
• Needs assessment
Recovery, Rehabilitation
• Spatial planning
• Infrastructure
• Housing
• Livelihood

Prime Advantages of GIS



GEOSAPTIAL DATA

- Maps
- Air photography… Photogrammetry… II World War
- Satellites…
- Computers .. Maps in digital form… Layers
- GIS

Various Technologies in GIS

- Remote Sensing
- GIS
- GPS
- UAV
- Internet
- ITS
- GPR

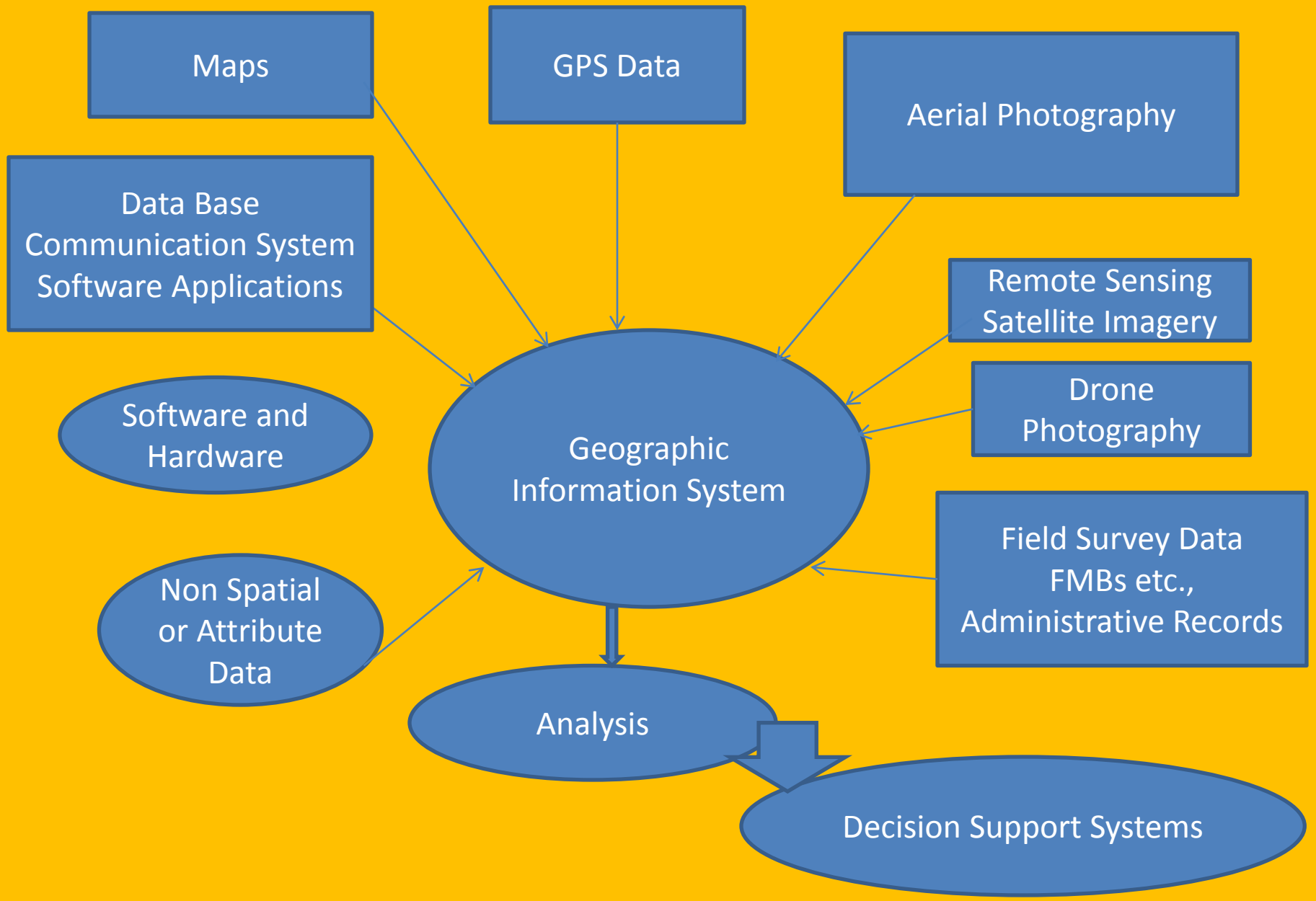
The major areas of GIS application

- Local Government
  - Public works/infrastructure management (roads, water, sewer)
  - Planning and environmental management
  - property records and appraisal
- Real Estate and Marketing
  - Retail site selection, site evaluation
- Public safety and defense
  - Crime analysis, fire prevention, emergency management, military/defense
- Natural resource exploration/extraction
  - Petroleum, minerals, quarrying
- Transportation
  - Airline route planning, transportation planning/modeling
- Public health and epidemiology
- The Geospatial Industry
  - Data development, application development, programming

Some GIS Applications

- **Urban Planning, Management & Policy**
  - Zoning, subdivision planning
  - Land acquisition
  - Economic development
  - Code enforcement
  - Housing renovation programs
  - Emergency response
  - Crime analysis
  - Tax assessment
- **Environmental Sciences**
  - Monitoring environmental risk
  - Modeling storm water runoff
  - Management of watersheds, floodplains, wetlands, forests, aquifers
  - Environmental Impact Analysis
  - Hazardous or toxic facility siting
  - Groundwater modeling and contamination tracking
- **Political Science**
  - Redistricting
  - Analysis of election results
  - Predictive modeling
- **Civil Engineering/Utility**
  - Locating underground facilities
  - Designing alignment for freeways, transit
  - Coordination of infrastructure maintenance
- **Business**
  - Demographic Analysis
  - Market Penetration/ Share Analysis
  - Site Selection
- **Education Administration**
  - Attendance Area Maintenance
  - Enrollment Projections
  - School Bus Routing
- **Real Estate**
  - Neighborhood land prices
  - Traffic Impact Analysis
- **Health Care**
  - Epidemiology
  - Needs Analysis
  - Service Inventory

Geographic Information System



Transportation and GIS

- Spread over a large geographic area.
- Mapping or geospatial data plays a key role in planning
- Transportation Planning needs Technical/Engineering as well as socio economic data and it's integration.
- GIS technology provides best software platform for integration, manipulation and utilization of this data.

TRANSPORTATION

- Transportation Planning… Roads, Railways, Bus Stations, Bus Depots, Bus Bays, Route Planning, Schedules etc.,
- Traffic Engineering and Planning. Traffic Management, Parking and establishments location.
- Road geometrics and other features.

Transportation Planning

- Estimation of demand
  - Need and demand for travel, Infrastructure needed.
  - Locational importance various features and facilities.
  - Designing Transportation systems like network, facilities.

What does GIS provide

- Geospatial data of Engineering quality.

  a. For geometric design of the road.

  b. Complete geographical data of the area for network planning.

  c. Complete spatial and non spatial data for planning location of facilities like bridges, terminals etc.

  d. Complete spatial and non spatial data for management exercises.

Contd..

- Integration of spatial and nonspatial data to facilitate interaction between various components of the system and thereby provide a scientific decision support system.
- An integrated control system of the complete project.
- Ease in editing, adding new data and data manipulation. Specially suitable for planning, designing and managing large public trasport systems.

CHARACTERISTICS OF THE GEOGRAPHIC INFORMATION SYSTEMS APPLICATION:

- Geospatial data is the backbone
- Covers Large geographic area
- Impact and interaction of component features are considered
- Produces a Scientific Decision Support System
- Up Scalable
- Need not be open needed.

EAMCET

- Application of GIS in organizing EAMCET examination in a city.
- Map of the City.
- Addresses of Students.
- Schools with capacity and facilities.
- Transportation logistic details.
- Social Events that may affect.
- Allotment of Student to nearest centre.

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Agricultural Applications:

GIS can be used to create more effective and efficient farming techniques. It can also analyze soil data and to determine: what are the best crop to plant?, where they should go? how to maintain nutrition levels to best benefit crop to plant?. It is fully integrated and widely accepted for helping government agencies to manage programs that support farmers and protect the environment. This could increase food production in different parts of the world so the world food crisis could be avoided.

Disaster Management and Mitigation:

Today a well-developed GIS systems are used to protect the environment. It has become an integrated, well developed and successful tool in disaster management and mitigation. GIS can help with risk management and analysis by displaying which areas are likely to be prone to natural or man-made disasters. When such disasters are identified, preventive measures can be developed.

Natural Resources Management:

By the help of GIS technology the agricultural, water and forest resources can be well maintain and manage. Foresters can easily monitor forest condition. Agricultural land includes managing crop yield, monitoring crop rotation, and more. Water is one of the most essential constituents of the environment. GIS is used to analyze geographic distribution of water resources. They are interrelated, i.e. forest cover reduces the storm water runoff and tree canopy stores approximately 215,000 tons carbon. GIS is also used in afforestation.

GIS Solutions in Banking Sector:

Today rapid development occurs in the banking sector. So it has become more market driven and market responsive. The success of this sector largely depends on the ability of a bank to provide customer and market driven services. GIS plays an important role providing planning, organizing and decision making.

Wetland Mapping:

Wetlands contribute to a healthy environment and retain water during dry periods, thus keeping the water table high and relatively stable. During the flooding they act to reduce flood levels and to trap suspended solids and attached nutrients. GIS provide options for wetland mapping and design projects for wetland conservation quickly with the help of GIS. Integration with Remote Sensing data helps to complete wetland mapping on various scale. We can create a wetland digital data bank with spices information using GIS.

GIS Applications in Geology:

Geologists use GIS in a various applications. The GIS is used to study geologic features, analyze soils and strata, assess seismic information, and or create three dimensional (3D) displays of geographic features. GIS can be also used to analyze rock information characteristics and identifying the best dam site location.

Detection of Coal Mine Fires:

GIS technology is applied in the area of safe production of coal mine. Coal mine have developed an information management system, the administrators can monitor the safe production of coal mine and at the same time improve the abilities to make decisions. Fire happens frequently in coal mines. So it can assessed spontaneous combustion risk using GIS tools.(Kun Fang, GIS Network Analysis in Rescue of Coal Mine).

Land Information System:

GIS based land acquisition management system will provide complete information about the land. Land acquisition managements is being used for the past 3 or 4 years only. It would help in assessment, payments for private land with owner details, tracking of land allotments and possessions identification and timely resolution of land acquisition related issues.

GIS based Taxation:

In Local Governments, GIS is used to solve taxation problems. It is used to maximize the government income. For example, for engineering, building permits, city development and other municipal needs, GIS is used. Often the data collected and used by one agency or department can be used by another. Example Orhitec ltd can supply you with a system to manage property tax on a geographic basis that can work interactively with the municipal tax collection department. Using GIS we can develop a digital taxation system.

Assets Management and Maintenance:

GIS helps organizations to gain efficiency even in the face of finite resources and the need to hold down the cost. Knowing the population at risk enables planners to determine where to allocate and locate resources more effectively. Operations and maintenance staff can deploy enterprise and mobile workforce. GIS build mobile applications that provide timely information in the field faster and more accurate work order processing.

GIS for Planning and Community Development:

GIS helps us to better understand our world so we can meet global challenges. Today GIS technology is advancing rapidly, providing many new capabilities and innovations in planning. By applying known part of science and GIS to solve unknown part, that helps to enhance the quality of life and achieve a better future. Creating and applying GIS tools and knowledge allow us integrating geographic intelligence into how we think and behave.GIS in Dairy Industry:

Geographic Information System is used in a various application in the dairy industry, such as distribution of products, production rate, location of shops and their selling rate. These can be monitored by using GIS system. It can be also possible to understand the demand of milk and milk products in different region. GIS can prove to be effective tool for planning and decision making for any dairy industry. These advantages has added new vistas in the field of dairy farm and management.

Tourism Information System:

GIS provides a valuable toolbox of techniques and technologies of wide applicability to the achievement of sustainable tourism development. This provide an ideal platform tools required to generate a better understanding, and can serve the needs of tourists. They will get all the information on click, measure distance, find hotels, restaurant and even navigate to their respective links. Information plays a vital role to tourists in planning their travel from one place to another, and success of tourism industry. This can bring many advantages for both tourist and tourism department.

Irrigation water management:

Water availability for irrigation purposes for any area is vital for crop production in that region. It needs to be properly and efficiently managed for the proper utilization of water. To evaluate the irrigation performance, integrated use of satellite remote sensing and GIS assisted by ground information has been found to be efficient technique in spatial and time domain for identification of major crops and their conditions, and determination of their areal extent and yield. Irrigation requirements of crop were determined by considering the factors such as evapotranspiration, Net Irrigation Requirement, Field irrigation Requirement, Gross Irrigation Requirement, and month total volume of water required, by organizing them in GIS environment. (A. M. Chandra, S. K. Ghosh, Remote Sensing and Geographical Information System)

Fire equipment response distance analysis:

GIS can be used to evaluate how far (as measured as via the street network) each portion of the street network is from a firehouse. This can be useful in evaluating the best location for a new firehouse or in determining how well the fire services cover particular areas for insurance ratings.(Himachal Pradesh, Development Report)

Worldwide Earthquake Information System:

One of the most frightening and destructive phenomena of nature is the occurrence of an earthquake. There is a need to have knowledge regarding the trends in earthquake occurrence worldwide. A GIS based user interface system for querying on earthquake catalogue will be of great help to the earthquake engineers and seismologists in understanding the behavior pattern of earthquake in spatial and temporal domain. (A. M. Chandra, S. K. Ghosh Remote Sensing and Geographical Information System)

Volcanic Hazard Identification:

Volcanic hazard to human life and environment include hot avalanches, hot particles gas clouds, lava flows and flooding. Potential volcanic hazard zone can be recognized by the characteristic historical records of volcanic activities, it can incorporate with GIS. Thus an impact assessment study on volcanic hazards deals with economic loss and loss of lives and property in densely populated areas. The GIS based platforms enables us to find out the damage and rapid response against volcanic activities may helps to reduce the effect in terms of wealth and health of people.

Energy Use Tracking and Planning:

GIS is a valuable tool that helps in the planning organizing and subsequent growth in the energy and utilities industries. The effective management of energy systems is a complex challenge. GIS has enormous potential for planning, design and maintenance of facility. Also it provide improved services and that too cost effectively.

GIS for Fisheries and Ocean Industries:

GIS tools add value and the capability to ocean data. ArcGis is used to determine the spatial data for a fisheries assessment and management system. It is extensively used in the ocean industry area and we get accurate information regarding various commercial activities. To enhance minimizing cost for the fishing industry. Also it can determine the location of illegal fishing operations.

Monitor Rangeland Resources:

GIS is a valuable tool used to monitor the changes of rangeland resource and for evaluating its impact on environment, livestock and wild life. Accurate observation and measurements are to be made to find out the changes in the rangeland conditions. GIS is also used to monitoring ecological and seasonal rangeland conditions .

Reservoir Site Selection:

GIS is used to find a suitable site for the dam. GIS tries to find best location that respect to natural hazards like earthquake and volcanic eruption. For the finding of dam site selection the factors include economic factors, social considerations, engineering factors and environmental problems. This all information are layered in the GIS.

Forest Fire Hazard Zone Mapping:

Forest is one of the important element of the nature. It plays an important role in the local climate. Forest fires caused extensive damage to our communities and environmental resource base. GIS can effectively use for the forest fire hazard zone mapping and also for the loss estimation. GIS also help to capture real time monitoring of fire prone areas. This is achieved by the help of GNSS and satellite Remote Sensing.

Pest Control and Management:

Pest control helps in the agricultural production. Increasing in the rate of pest and weeds can lead to decrease in the crop production. Therefore GIS plays an important role to map out infested areas. This leads in the development of weed and pest management plan.

Traffic Density Studies:

GIS can effectively use for the management of traffic problems. Today's population along with the road traffic is increasing exponentially. The advantage of GIS make it an attractive option to be used to face the emerging traffic problems. By creating an extensive database that has all the traffic information such as speed data, road geometry, traffic flow and other spatial data and processing this information will provide us the graphical bigger picture for the traffic management.

Deforestation:

Nowadays forest area is decreasing every year, due to different activities. GIS is used to

Space Utilization:

GIS helps managers to organize and spatially visualize space and how it can best be used. Operational costs can be decreased by more efficiently using space including managing the moves of personal and assets as well as the storage materials. The 3D visualization in GIS platforms helps planers to create a feeling of experience like virtual walk inside the building and rooms before construction.

Snow Cover Mapping and Runoff Prediction:

Systematic, periodical and precise snow cover mapping supported by GIS technology, and the organization of the results in a snow cover information system forms the basis for a wide range of applications. On the practical side, these applications are related to the monitoring of seasonal and yearly alterations of the snow cover under the presently existing climatic conditions, to simulate and forecast runoff, to map the regional distribution of the water equivalent, and to document the recession process of the snow cover during the melting period in its relation to geological features.

GIS for Wildlife Management:

Man made destruction such as habitat loss, pollution, invasive species introduction, and climate change, are all threats to wildlife health and biodiversity. GIS technology is an effective tool for managing, analyzing, and visualizing wildlife data to target areas where international management practices are needed and to monitor their effectiveness. GIS helps wildlife management professionals examine and envision.

Geologic Mapping:

GIS is an effective tool in geological mapping. It becomes easy for surveyors to create 3D maps of any area with precise and desired scaling. The results provide accurate measurements, which helps in several field where geological map is required. This is cost effective and offers more accurate data, there by easing the scaling process when studying geologic mapping.

Environment:

The GIS is used every day to help protect the environment. The environmental professional uses GIS to produce maps, inventory species, measure environmental impact, or trace pollutants. The environmental applications for GIS are almost endless. It can be used to monitor the environment and analyze changes. GIS is the best tool in EIA studies.

Infrastructure Development:

Advancement and availability of technology has set a new mark for professionals in the infrastructure development area. Now more and more professionals are seeking help of these technologically smart and improved information systems like GIS for infrastructure development. Each and every phase of infrastructure life cycle is greatly affected and enhanced by the enrollment of GIS.

Coastal Development and Management:

The coastal zone represents varied and highly productive ecosystem such as mangrove, coral reefs, see grasses and sand dunes. GIS could be generating data required for macro and micro level planning of coastal zone management. GIS could be used in creating baseline inventory of mapping and monitoring coastal resources, selecting sites for brackish water aquaculture, studying coastal land forms.

Crime Analysis:

GIS is a necessary tool for crime mapping in law enforcement agencies worldwide. Crime mapping is a key component of crime analysis. Satellite images can display important information about criminal activities. The efficiency and the speed of the GIS analysis will increase the capabilities of crime fighting.

River Crossing Site Selection for Bridges:

The important geotechnical consideration is the stability of slope leading down to and up from the water crossing. It is advisable to collect historical data on erosion and sedimentation. On the basis of these information asses the amount of river channel contraction, degree of curvature of river bend, nature of bed and bank materials including the flood flow and the flow depth, all these can be done in GIS within estimated time and accurately. This information has been often used for river crossing site selection for bridges.

Land Use Changes Associated with Open Cast Strip Mining:

Mining is the back bone of the developing economy of any country. Mapping, monitoring and controlling the impact caused by the mining activities is necessary so as to understand the character and magnitude of these hazardous events in an area. The data required to understand the impact of mining from the environment is coming from different discipline, which need integration in order to arrive hazard map zonation.

Economic Development:

GIS technology is a valuable tool used for the economic development. It helps in site selection, suitability analysis, and for finding the right sites to locate new business and grow existing ones. Within economic development, GIS is used to support the emerging trend of economic gardening, a new way to foster local and regional economic growth by existing small business in the community. In Hyderabad, a business house has set up a super market in 1990s after conducting a crude GIS exercise. The result was so good that for rest of their stores, they adopted the same method.

Locating Underground Pipes and Cables:

Pipe line and cable location is essential for leak detection. It can be used to understand your water network, conducting repairs and adjustments, locating leaks known distance for correlating etc. Pipelines are continually monitored, check for leak detection and avoid the problem of geo hazards.

Knowledge Based System for Defense Purpose:

Regular analysis of terrain is essential for today's fast paced battlefield. Conventional method of studying paper topographical maps is being replaced by use of maps in digital form to get terrain information. It is increasingly being used to derive terrain information from digital images. Which help to the selection of suitable sites for various military uses more accurate and faster. The uses of GIS provide information regarding the terrain features which can be useful for planning today's war strategies.

Pipeline Route Selection:

Pipeline route planning and selection is usually a complex task. GIS technology is faster, better and more efficient in this complex task. Accurate pipeline route selection brings about risk and cost reduction as well as better decision making process. GIS least cost path analysis have been effectively used to determine suitable oil and gas pipeline routes. An optimal route will minimize reduce economic loss and negative socio-environmental impacts.

Development of Public Infrastructure Facilities:

GIS has many uses and advantages in the field of facility management. GIS can be used by facility managers for space management, visualization and planning, emergency and disaster planning and response. It can be used throughout the life cycle of a facility from deciding where to build to space planning. Also it provides facilitate better planning and analysis.

GIS for Public Health:

GIS provides the cost effective tool for evaluating interventions and policies potentially affecting health outcomes. GIS analysis, environmental health data is also helpful in explaining disease patterns of relationships with social, institutional, technological and natural environment. It can be understand the complex spatial temporal relationship between environmental pollution and disease, and identifying exposures to environmental hazards. GIS can significantly add value to environmental and public health data. In the recent CORONA pandemic, several GIS based tools and applications were made, to Identify the affected areas, persons, facilities etc.. AAROGYA SETHU is also one such attempt.

Desertification:

Desertification is the land degradation due to climatic variations or human activities. GIS can provide the information of degraded land which can be managed by governmental agencies or by the communities themselves. GIS plays a vital role to reduce the desertification, the local governments are now widely depends on GIS for reducing desertification. With location based GIS analysis we can find where or which area is suitable for planting new vegetation and which area for the pipeline construction.

Regional Planning:

Every day, planners use Geographic Information System (GIS) technology to research, develop, implement, and monitor the progress of their plans. GIS provides planners, surveyors, and engineers with the tools they need to design and map their neighborhoods and cities. Planners have the technical expertise, political savvy, and fiscal understanding to transform a vision of tomorrow into a strategic action plan for today, and they use GIS to facilitate the decision-making process. (ESRI, GIS Solutions for Urban and Regional Planning)

GIS for Land Administration:

In a number of countries, the separate functions of land administration are being drawn together through the creation of digital cadastral databases, with these database they can reuse land for suitable needs ,digital taxation and even utilities are also easily handle using these database.

Coastal Vegetation Mapping and Conservation:

Coastal vegetation like Mangroves are the protectors of coast from natural hazards like tsunami , so that the conservation of these vegetation are highly important. GIS enable us to map which are having higher density of vegetation and which area need more vegetated? Integration of these details to coastal zone mapping helps to identify the area prone to coastal erosion and we can plant more vegetation to reduce coastal erosion.

GIS and Society

With the popularization of GIS in decision making, scholars have began to scrutinize the social implications of GIS. It has been argued that the production, distribution, utilization, and representation of geographic information are largely related with the social context. For example, some scholars are concerned that GIS may not be misused to harm the society. Other related topics include discussion on copyright, privacy, and censorship. A more optimistic social approach to GIS adoption is to use it as a tool for public participation.

Open Geospatial Consortium (OGC) standards

The Open Geospatial Consortium (OGC) is an international industry consortium of 334 companies, government agencies and universities participating in a consensus process to develop publicly available geo-processing specifications. Open interfaces and protocols defined by OpenGIS Specifications support interoperable solutions that "geo- enable" the Web, wireless and location-based services, and mainstream IT, and empower technology developers to make complex spatial information and services accessible and useful with all kinds of applications. Open Geospatial Consortium (OGC) protocols include Web Map Service (WMS) and Web Feature Service (WFS).