

Study of Geographical Information System and its Applications

S. Mishra¹ and P. Chandekar²

*¹Department of EECE, ITM University, Gurgaon, INDIA.
²VESIT College, Chembur, Mumbai, INDIA.*

Abstract

This paper represents the study about Geographical Information System and its applications to improve the performance of various sectors. GIS collects data, processes it, analyzes in best possible way for collaborative decision making about the use of land and environment. The system enhances the scope and gives new challenges to engineers to develop more efficient system having the power to facilitate telecommunication, industrialization, business processes, medical services, agricultural activities, transportation, planning and management as well as governance. GIS technology gives new way to boost scientific research and development and keeps updating the information about the changes occurring on the cover of the Earth, climate changes and natural resources. In addition, conjunction of GIS with sensor networks increases the area of supervision and exploration.

Keywords: Geographical Information System, collaborative decision making, sensor network.

1. Introduction

Computer science and communication engineering has invented various useful technologies, which have become the need of our daily lives. One important outcome is an information system that facilitates user to collect data, process it to extract required information and then use this information to take necessary decisions. This versatile system is widely applicable in business, institutions, organizations, research and development. The information system use to collect, integrate, analyze and process geographical data is known as geographical information system. GIS technology is

application oriented that means it provides the information of particular geographical area under supervision, which can be utilized for the required feature detection, integration and then application of faithful procedures and policies to accomplish the objective.

The term Geographical information system was used for the first time by Roger Tomlinson in 1968. Though the system was already into the existence, application was limited to some areas only. Emergence of internet has strengthened this technique in 20th century. Now this technology influences almost all the sectors wherever the geographical area has deep impact on the performance and development. GIS scans the area under supervision from satellites or aerial sources and extracts the information on the basis of an algorithm, which is used according to the application. As in this era of digitization every technique works on digital data, GIS too is not different from them.

2. Needs and Requirements

Every system is a combination of hardware devices and software programs. Usually GIS system need sensing element, photographic tools and Computer Aided Design tool that gives 3D view of the image and highlights the features. GIS is comprised of five important components

- Hardware devices- to scan or sense the necessary parameter, storage and processing
- Software programs- to drive the devices and components, increase interaction with hardware
- Data- the parameter to be sensed and processed
- People- the developer and user group
- Methods- algorithms to collect information and then applied according to the targeted areas like business, firms etc.

System will perform faithfully if the software has designed such a way that it agrees on integrity, reliability, confidentiality, robustness, flexibility and stability of the system. GIS software executes following functions:-

- Data acquiring - capture image, coordinates, attributes etc.
- Editing of data – checking errors and features
- Data management- storage, buffering, digitization and versioning.
- Data analysis- feature extraction, boundary and terrain analysis, spatial and temporal analysis.
- Generate final output- digital map (2D or 3D format)

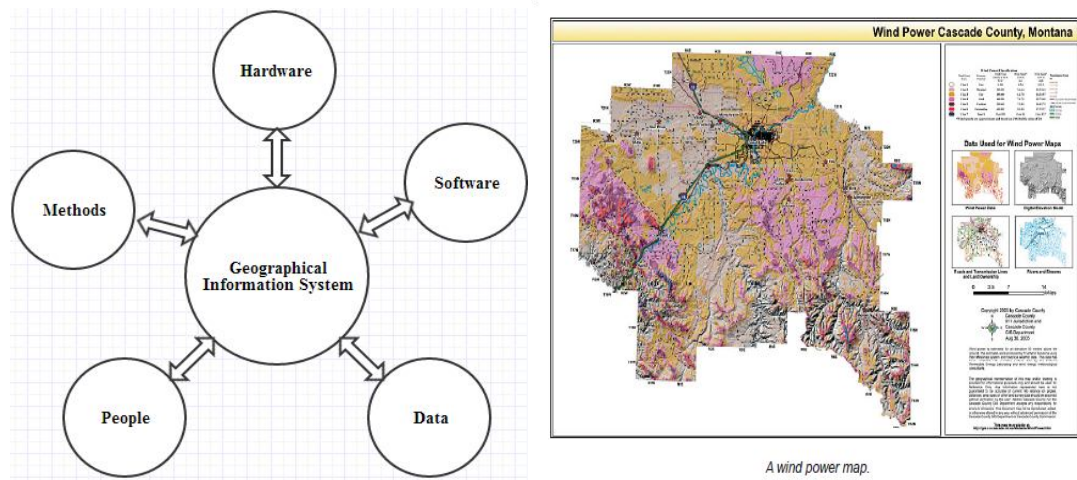


Figure 1: The components of GIS system (LHS) and an example of GIS solution (source [1])

3. Applications of GIS Technology

3.1 Business

GIS provides the information regarding the transport facilities, business condition, customer life style, customer age group and choice and other customer related queries. This information leads to the proper decision making about the launching of the product and business enhancement. Real estate management and architectural process are highly influenced by this technology.

3.2 Crime Analysis

The technology maps the crime hotspots that are industries, banks, school and colleges etc. of the region, state and country. This helps to the law department as well as government to build such a strategy which helps to deal with all criminal activities.

3.3 Communication Industries

Telecommunication technology is trying to connect every small region or town to the metro cities. GIS system supports this globalization and delivers the information where to deploy the base stations and other essential units of the communication for the proper and unbreakable coverage.

3.4 Agricultural sectors

Lands that can be incorporated to increase the field of agriculture and enhance productivity can be found, which encourages increasing the agricultural assets in developed and most efficiently in developing countries. Moreover it facilitates employment in rural areas.

3.5 Medical services

During hazardous situations like epidemic, natural calamities like earthquake, flood etc. GIS maps the regions that need the medical facilities. Also during accident or any other medical disability, the system gives information about the nearest medical center availability.

Drishhti is a wireless navigation system for pedestrians basically designed for the blinds. This system gathers information about the obstacles of the path and environmental conditions and guides them through the voice cues.

3.6 Natural resources availability

As GIS collects the data of the entire region, it gives indication about the available natural resources, plant and animal species, endangered and vulnerable species etc. This also helps to find out new species yet to be introduced and the resources that are going to be exhausted.

3.7 Traffic monitoring

This is another application of GIS. Traffic can be controlled and accidents can be avoided by effective supervision and guidance provided by the traffic officers.

3.8 Governance

If the entire region can be supervised at a one place and regulations, laws and authorities are implemented related to the required scenarios then the governance becomes easy as well as satisfactory. If citizens are satisfied due to availability of all the resources, privacy, safety and employment, government can satisfactorily survived in a country without any conflict.

3.9 Research and development

To research on space and resources present on the Earth surface GIS is an admirable technology. NASA and its partners have developed three dimensional geographical information system - *NASA World Wind*. It works on extra terrestrial bodies as well as astronomical data.

3.10 Mobile GIS

This is an amalgamation of GPS (global positioning system) and GPRS (general packet radio service) technology and provides real time services that can be access anywhere anytime.

3.10 Defense forces

GIS system provides geographical information of enemies and their sources that leads to the proper planning of defensive and offensive actions.

4. Things that Make GIS –A Beneficial Technology

Implementation of GIS technology supports to make our planet green and healthy. GIS based solutions emphasize to solve environmental problems and empower sustainable development. In present scenarios GIS is being applied to solve multiple issues in different countries. The only limit to GIS application is the limit of imagination. Here are some examples of GIS based solutions that has been applied-

- GIS is used by Cascade County, Montana, to map the most favorable locations for wind farms for the promotion of green energy source.
- Buffalo, New York, uses GIS to maintain its urban forest inventory.
- In Jakarta, Indonesia, GIS-based scientific studies, helped to reduce air pollution. The government has implemented strategies to improve air quality.
- GIS is being used to study to minimize global warming caused by CO2 emission.
- The U.S. Army Corps of Engineers used GIS to restore the natural habitat of the Middle Rio Grande in New Mexico [1].
- City of Boston, Massachusetts, is implementing solar energy program by using GIS to calculate the solar radiation available on city rooftops [1].

5. Conclusion and Future Scope

GIS technology is very vast field and applicable in almost every sector of the society. Internet emergence is a land mark in the global information collection process. Hence it can observed that the system provides –

- Single platform to collect multiple data.
- It reaches to every remote lands and regions.
- Scalable software to perform operations on multiple features.
- Easy to use and understand.
- Provides continues supervision o suspected areas.
- Cost effective system.
- Increases performance and productivity.
- Ensures safety and security
- Employment opportunities
- Encourages innovation to find out the solutions of various disabilities.
- Tool to help in overall development
- Also useful in disaster management
- Helps in scientific research
- GIS is a green technology [1].

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