ROADMAP OF
GEOSPATIAL LABORATORY

DEPARTMENT OF GEOMATICS ENGINEERING

FACULTY OF CIVIL, PLANNING AND GEO-ENGINEERING

INSTITUT TEKNOLOGI SEPULUH NOPEMBER

SURABAYA, 2020

Laboratory Profile

Geospatial Laboratory is one of five laboratories owned by the Geomatics Engineering Department, Institut Teknologi Sepuluh Nopember. The focus of academic and research activities in this laboratory is the applications of geodetic and geomatic instrumentation, especially using Remote Sensing and Geographic Information System to solve problems, provide innovation and ideas development, and support decision-making in the global community related to geospatial information.

Geospatial information is information that has spatial references. It is able to be presented spatially in the form of maps with certain geographic reference systems. In a more specific term, geospatial information is a computer system that has the ability to build, store, manage, and display geographically referenced information such as data identified by location, in a database. The people who build and operate the system and the data is also part of the system.

Indonesia as a country located in the ring of fire is very vulnerable to natural disasters such as earthquakes, tsunamis, volcanic eruptions, and landslides. Likewise, disasters that are triggered by human behavior, such as landslides, land subsidence, and floods. Disaster mitigation is very necessary to overcome the problems that arise at the time of the incident, for example modeling community evacuation routes when a volcano erupts. Another example is to prevent damage to the environment and infrastructure by continuously monitoring areas at risk, such as monitoring the movement of slopes in landslide or deformation areas in major Indonesian cities.

With the development of technology in the field of geospatial information, georeferenced-based innovations will help the acceleration and effectiveness of denominational activities, for example in the marine and fisheries sector, geospatial technology can present fish catchment areas in a sustainable manner using Remote Sensing techniques and Geographic Information Systems (GIS).

As a decision-making in the global community, many applications based on geospatial information are often applied in everyday life. One of them is an interactive map which is currently widely applied to everyday electronic devices or on computer browsing using geo-reference-based technology. With this application, we can view satellite images or maps from various regions around the world as well as the environment in which we live. These applications are also often used by the general public to view and access information on traffic conditions.

Laboratory Members

Table 1 Laboratory Members

Lecturer ID	Lecturer Name	Status
199008072015041001	Husnul Hidayat, ST, MT	Head of Laboratory
195305271983031001	Prof. Dr. Ir. Bangun Muljo Sukojo, DEA, DESS	Member
198012212003121001	Lalu Muhamad Jaelani, ST, M.Sc, PhD	Member
199006032014042001	Dr-Ing. Noorlaila Hayati, ST, MT	Member

Laboratory Road Map Description

Geospatial Information Technology can be used for scientific investigations, resource management, development planning, cartography and route planning. For example, GIS can help planners to quickly calculate emergency response times in the event of a natural disaster, or GIS can be used to find wetlands that need protection from pollution.

A Geospatial Information (GIS) uses computers and software to take advantage of the basic principles of geography, locations that are important in human life. Geospatial Information helps retail businesses find the best place for their next store and helps agencies track environmental degradation. This system helps the truck route delivery and manage road paving. It also helps marketers find new prospects, and helps farmers increase production and manage their land more efficiently.

Geospatial Information takes numbers and words from rows and columns in databases and spreadsheets, and places them on maps. Putting our data on a map is like we have a shop and there are a lot of customers, or some leaks in the water system if we run a water company. This allows us to view, understand, question, interpret, and visualize our data in simple ways in spreadsheet rows and columns.

Geospatial Information System (GIS) now combines maps (in digital form) with all data from all relevant agencies. For example, instead of having a cadastral map here and a land book there, the parcel map and ownership data are combined in one system. Or, instead of using a land use plan on a large sheet of paper and searching separately for demographic data to find the best location for a new school, investigations can be sent to a computer that instantly produces a map showing the perfect location.

There are many experts who try to give a proper understanding of Geospatial Information. Some of the definitions according to these experts include:

- Geospatial Information is a spatial data handling system (Marble *et al* 1984)
- Geospatial Information is an important computerized data system (Calkin and Tomlison 1984)
- Geospatial information is a useful tool for collecting, hoarding, retrieving desired data and displaying spatial data originating from world realities (Burrough 1986)
- Geospatial information is a system for managing, storing, processing (manipulation), analyzing and displaying spatial data related to the earth's surface (Linden 1987)
- Geospatial information is an information system, internal reference, and spatial data automation (Berry 1988)
- Geospatial information is an information system based on computer work that enters, manages, manipulates and analyzes data and provides descriptions (Aronoff 1989)
- Geospatial information is a system that can support spatial decision making and is able to integrate location descriptions with the characteristics of the phenomena found in that location. A complete GIS includes the necessary methodologies and technologies, namely spatial data on hardware, software and organizational structures (Gistut 1994)
- Geospatial information is an information system that is used to enter, store, recall, process, analyze and produce geographically referenced data or geospatial data, to support decision making in planning and management of land use, natural resources, environment, transportation, city facilities, and other public services (Murai 1999)

- According to Kang-Tsung Chang (2002), Geospatial Information as a computer system for capturing, storing, querying, analyzing, and displaying geographic data.
- Geospatial information as a computer system used to manipulate geographic data. This system is implemented with computer hardware and software that functions for data acquisition and verification, data compilation, data storage, data change and updating, data management and exchange, data manipulation, data calling and presentation and data analysis (Bernhardsen 2002)
- According to Alter, Geospatial information is an information system that supports data organization, so that it can be accessed by pointing to an area on a map.
- According to Prahasta, Geospatial Information is a type of software that can be used for the entry, storage, manipulation, display, and output of Geospatial information and its attributes.
- According to Petrus Paryono, Geospatial Information is a computer-based system used to store, manipulate and analyze Geospatial information.

From the definitions above, it can be concluded that GIS is a geographic data management based on computer work (machine).

Initially, Geospatial information was used to perform spatial data analysis. From a geographic data processing point of view, GIS is not a new invention. In line with the development of science in the field of digital technology, Geospatial information can be used for several purposes, namely:

- Data acquisition and digitization process, editing, topology development, data format conversion, attribute assignment, etc.
- Database management such as data archiving, data modeling, and attribute search.
- Spatial measurement and analysis of measurement operations.
- Visualization in the form of graphics, scale transformations, generalizations, and topographic maps.

Geospatial information system (GIS) capability is the capability of GIS in various fields such as:

- Description of a map element
- Identification of map elements such as determining suitable locations for agricultural land development
- Identify the trend of changing spatial trends of various map elements.
- Modeling the system to solve more complex problems.

Laboratory Activities

The 2020 Roadmap reflects the lifecycle that has been carried out by the geospatial laboratory and fills the gaps that have been evaluated by the Geomatics Engineering department and sharpens the advantages gained from research projects and academic activities carried out by the laboratory.

Research covering strategic sectors in industrial development 4.0 is described in the chart below.

Communication

- Meet or consult in person at the Geomatics Engineering Building
- Virtually with Email, myITSclassroom, and virtual meeting platforms (e.g. Zoom, Google Meeting, etc.)

Publication

- Scientific publications in National and International Journals
- Public articles that can be accessed on the official Geomatics Engineering - ITS website

Three Pillars of Higher Education

a. Education

List of Courses Managed by Geospatial Laboratory

Number	Course Name	Semester	Class	Practicum
1	Cartography	1	2	2
2	Spatial Data Computation and Programming	2	2	2
3	Toponym	3	2	2
4	Spatial Database System	3	2	2
5	Introduction to Remote Sensing	3	2	2
6	Digital Photogrammetry	5	2	2
7	Introduction to Geographic Information	6	2	2

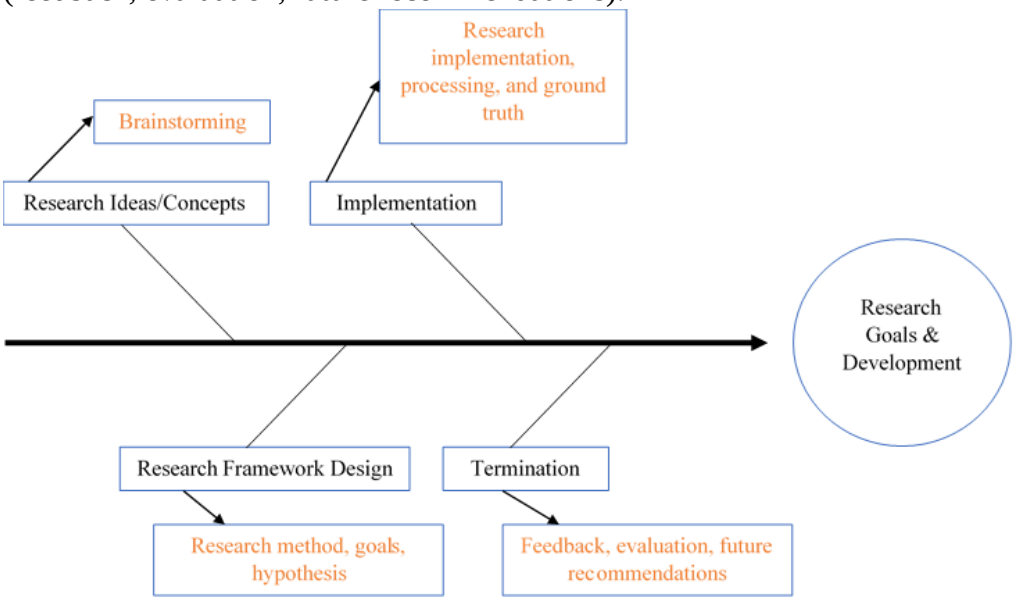
8	Geospatial Information Infrastructure	6	1	1
9	Thematic Geospatial Information	6	1	1
10	Radargrammetry Application	7	1	1
11	Hyperspectral Remote Sensing	7	1	1

Explanation:

- The Role of the Laboratory in the Teaching and Learning Process
- Courses / practicum in the Study Program Curriculum managed or served by the laboratory, and etc

b. Research

The research activity begins with the determination of the Research Concept / Idea, followed by the design of the research framework (methods, objectives, hypotheses), implementation (research implementation, ground truth operations), and termination (feedback, evaluation, future recommendations).



The following research road map outlined in the implementation section above is depicted in the following diagrams and tables:

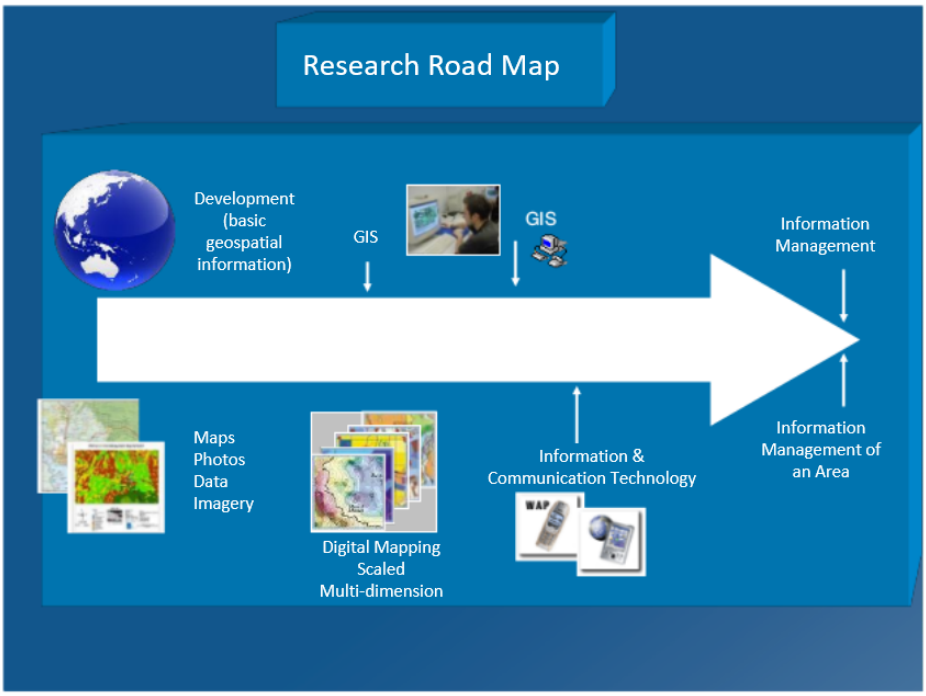


Table 2 Research Road Map

Research Topics	Goals until 2017	2018	2019	2020	2021	2022	2023-2030
Marine Studies	Analysis of NOAA-AVHRR and MODIS satellite imagery algorithms for determining the distribution of sea surface temperature		Analysis of NOAA-AVHRR and MODIS satellite imagery algorithms for determining the distribution of coastal sedimentation		Socialization of the information system for the distribution of sea surface temperature as a WebGIS-based fishing ground indicator		Increasing fish catch production (fishing ground) of fishermen
Transportation and Urban Planning	Analysis of Landsat and SPOT Satellite Imagery Algorithms for Determining the Distribution of Growth in Urban Areas		Analysis of IKONOS and QUICKBIRD Satellite Imagery Algorithms for Determining Transportation Growth Distribution Patterns		Development of a GIS-based Transportation Growth Distribution Pattern Information System.		Socialization of Information Systems for Distribution Patterns of WebGIS-Based Transportation Growth.
Environmental Studies	Analysis of NOAA-AVHRR and MODIS Satellite Imagery Algorithms for Determining Environmental Quality (Mangrove Biodiversity, Industry, Vulnerability)		Development of a GIS-Based Environmental Quality Distribution Information System.				Socialization of Information System for Distribution of WebGIS-Based Environmental Quality.
Disaster Mitigation	Analysis of Landsat and SPOT Satellite Imagery Algorithms for Determination of Disaster-Prone Areas, Disaster Risk, Disaster Transmission, Disaster Potential, Deformation and Geodynamic Studies, Land Information Systems		Development of a GIS-Based Information System for Disaster Prone Areas.				Socialization of Information System for Disaster Prone Areas based on WebGIS.

	(land parcels, land status, ownership)			
Energy and Natural Resources	Analysis of Landsat and SPOT satellite imagery algorithm to determine the potential distribution of mining materials (coal, gold, nickel, etc.) and study of land deformation due to community mining activities	Development an information system for the distribution of potential mining materials (coal, gold, nickel, etc.) and land deformation due to GIS-based community mining activities	Socialization of information systems for the distribution of potential mining materials (coal, gold, nickel, etc.) and land deformation due to webGIS-based community mining activities	Increasing the production of potential mining materials (coal, gold, nickel, etc.) and land deformation due to community mining activities
	Analysis of Hymap and Airborne satellite imagery algorithm to determine the potential distribution of mining materials (coal, gold, nickel, etc.) and study of land deformation due to mining industry activities	Development of an information system for the distribution of potential mining materials (coal, gold, nickel, etc.) and land deformation due to GIS-based mining industry activities	Development of an WebGIS-based information system for the distribution of potential mining materials (coal, nickel, gold, etc.) and land deformation due to mining industry activities	Increasing the production of potential mining materials (coal, gold, nickel, etc.) and land deformation due to mining industry activities
Forestry and Agriculture	Analysis of Landsat and SPOT satellite imagery algorithm for determining the distribution of forestry potential (area, potential, plant types)	Development of a GIS-based forestry potential distribution information system (area, potential, plant types)	Socialization of forestry potential distribution information system (area, potential, types of plants) based on WebGIS	Increasing the potential production of community forestry (area, potential, types of plants)
	Analysis of Hymap and Airborne satellite imagery algorithm to determine the distribution of agricultural potential (land area, crop type, irrigation system, harvest time) and food security (study of soil and crop types, planting and harvest time)	Development of an information system for the distribution of agricultural potential (land area, crop types, irrigation system, harvest time) and food security (study of soil and crop types, planting and harvest time) based on GIS	Socialization of information system distribution of agricultural potential (land area, crop types, irrigation system, harvest time) and food security (study of soil and crop types, planting and harvest time) based on webGIS	Increasing agricultural production (land area, crop type, irrigation system, harvest time) and food security (study of soil and crop types, planting and harvest time)

	Fundamental Research
	Applied Research
	Industrial Research

c. Community Service/Dedication

1. Training
2. Action review
3. Development of prototype/model
4. Technical guidance
5. Consultation
6. Community services