GIS PROGRAMME WITH A HOLISTIC APPROACH

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ABSTRACT

GIS technology provides powerful tools for geographic analysis for almost all academic discipline. It is being taught in one way or other in Geography and Geology departments in most of the universities at introductory level, but t is only a recent development that it is emerging as an independent branch and only few universities have started full-fledged course on GIS. Looking to the very high potential of GIS applications as a career option, a number of students now choose GIS but in absence of adequate number of institutions offering this course only a handful get opportunities in getting admissions. The time has perhaps come to address this demand and academicians and experienced professionals from the industry should come forward to design a course structure suitable enough to fulfil this need. The objective being to generate professionals well equipped in all relevant tools and in complete sync with the requirements of the Industry. The initial batches from such a proactive programme would in fact act as the initiators of similar programmes in Universities and Institutions across the country.
We, at the Birla Institute of Technology Remote science department, have made an attempt in this direction and designed the M.Tech. GIS Programme, which we want to present with the purpose of seeking suggestions for further value addition.

Background

Knowledge of a comprehensive description and group of biophysical environment is essential for successful economic development and progress of a region. Moreover, the regional development and socio-economic uplift of a geographical/administrative area cannot take place on a desired line and level without:

- A comprehensive survey and assessment of natural and socio-economic resources of each unit, and
- A co-ordinated approach adopted for area development, i.e., colonisation of natural environment by involving technological and infrastructural efforts for the successful overall development and progress of an area.

The classification of a living space is a sine qua non for environmental geo-monitoring and problem identification, which is the pre-requisite for area development. The regional patterns of economic activities and development are influenced by the interaction between two sets of forces: These are the various combinations of **natural conditions** and **human circumstances** that operate concurrently within the framework of natural environmental complexes. These sets of forces, as such, were used as diagnostic indicators for the resource survey of environmental condition in geo-socio-economic expressions of any living space.

To achieve the above we should have appropriate trained manpower who are able to think spatially as well as can do complex spatial analysis and come out with multiple solutions.

Acute shortage of such skilled personnel is increasing day by day and a need to create a pool of such human resources who can not only understand spatial nature of problems but are able to provide multiple solutions using the knowledge of modern tools of Remote Sensing & GIS technologies. This is only possible when number of institutions come forward to impart appropriate courses in Geographic Information Sciences. Again to start a GIS course suitable for all is an uphill task. Because of it's multi-disciplinary nature and existing compartment kind of education systems many universities are not able to come forward to start such course, which has ample scope of job opportunities.

GIS the edge of Information Technology

The information Technology (IT) is changing everything and spatial information using Remote Sensing & Geographic Information System is no exception of it. While the last 30 years have witnessed an impressive growth in the use of aerial and satellite imagery, the real explosive growth has been observed during last five years when the use of GIS is increased in this field.

Two of the technologies of the 90's, the Internet & Geographic Information Systems (GIS) have changed the ways of accessing, sharing, disseminating and analysing data and information. The Internet has greatly improved the accessibility and transmission of all types of information. GIS is used to integrate analyse and display spatial data. The spatial information is fast becoming an important pre-requisite, in development, planning, and related actions taken up in most govt. departments. All the issues related to location specific solutions of a problem, sustainability of developmental activities and effective & efficient sustainable rural and agricultural development planning is to be based on spatial data resources inventory, of a particular geographic region. In this context, application such as land and water resources appraisal, soil conservation, hazard zonation, watershed management and utility mapping etc. has spatial significance for the development of a region.

In view of above needs and rapid advancements in the field of telecommunication, computers and remote sensing are resulting into information technology revolution. There is a paradigm shift in the entire gamut of spatial resources data management, for sustainable development planning.

Remote sensing and geographic Information system (GIS) are the two important components in the field of Information Technology related with spatial planning. In order to explore and exploit the vast opportunities offered by Geo-Information Technology to improve and accelerate the planning process, it is high time that we should come forward to support this new technology by starting new courses in GIS. At present no university is offering M.Tech. in GIS in India of it's own. In the light of increased demand and awareness about usage of spatial data and other databases, and availability of high-speed network, there is an urgent need to provide skilled manpower in the field of GIS. To achieve this, it was felt necessary to start one course in M.Tech. GIS. In this direction Birla Institute of Technology (BIT) which is having the advantage of a Department of Remote Sensing has come forward by introducing a new M.Tech. course in GIS with it's existing M.Tech. Remote Sensing course. At present there are only 6 or 7 Universities, which are giving M.Tech. Degree in Remote Sensing in India and they are teaching GIS as one of its core or elective paper in it. Few foreign Universities are also offering M.Sc./M.Tech. in GIS. Therefor there is a tremendous scope of job opportunist for students of this region in the field of GIS for years to come.

We all know that Map-making and geographic analysis is not new, but a GIS performs these tasks better and faster than do the old manual methods, and before the advent of GIS technology, only a few people had the skills necessary to use geographic information to help with decision making and problem solving. Today, GIS is a multibillion-dollar industry employing hundreds of thousands of people worldwide. GIS is becoming popular in schools, colleges, and universities throughout the world. Professionals in every field are increasingly aware of the advantages of thinking and working geographically.

The major challenges we face in the world today are overpopulation, pollution, deforestation, and natural disasters, which have a critical geographic dimension. Whether siting a new business, finding the best soil for growing bananas, or figuring out the best route for an emergency vehicle, local problems also have a geographical component. GIS is the power to create maps, integrate information, visualize scenarios, solve complicated problems, present

powerful ideas, and develop effective solutions like never before. GIS is a tool used by individuals and organizations, schools, governments, and businesses seeking innovative ways to solve their problems.

GIS facilitates various resource management activities. Once the information has been extracted from RS/other data and a database has been created in a GIS environment, it allows inventory of each of the resources. It allows one to obtain inventory at different administrative units as well as natural resource units like watershed /forest etc. It allows updating without much manual work.

The manifestation of the adverse impact of the unsustainable anthropogenic activities on the environment has paved the way for increased awareness and necessitated the adoption of an integrated approach for the optimal utilisation of our land and water resources. The capability of satellite remote sensing to provide an unbiased and synoptic view of the natural resources over a wide range of the electromagnetic spectrum, in a timely and cost effective manner is being efficiently utilised in the holistic approach. Beside, the spectacular developments in geographic Information system (GIS) to synthesise various thematic information with collateral data have not only made this technology effective and economical, but also an inevitable tool to arrive at sustainable development strategies for our land and water resources management.

GIS Education :the need of today

The increasing requirement of GIS education has shown over the years that there are three categories of people who have to be exposed to this technology.

- ***Decision Makers:*** This is the first level deals with people and policy and therefore should get a general awareness of the potential of GIS technology.
- ***Medium Level Bureaucrats:*** The second level categorises of the personnel from user departments who must understand the conceptual basis of GIS operations and analysis.
- ***Application Developers:*** Third level real technical manpower that will work in the systems and implement the applications in GIS environment.

The main hurdles in imparting training in GIS technology are the technical complexity of GIS concepts and the compulsion to work in a computing environment. Although public investment in GIS research such as the IIRS Dept. of Space, and IIT"s like Roorkey and Bombay and very few other Universities in India has added to the pool of skills but there is still a considerable demand for GIS education. In this context, we find now that several new technical books written by eminent authors and self- learning demonstration tools built around commercial packages are available to strengthen GIS education. This effort is advancement in this direction, as we have planned to start a new M.Tech. Level course in GIS as well as to start short term and medium term training programmes for middle and higher level officers of Govt. and PSU'S so that they may be able to use the data base created by the technocrats in this newly emerging field.

Scope of Such Course

Spatial information is vital to make sound decisions at the local, regional, state and central level planning, implementation of action plans, infrastructure development, disaster management support, and business development. Natural Resources management, flood mitigation, environmental restoration, land use planning are just a few examples of areas in which decision-makers benefit from spatial information.Until recently, maps (usually in paper form) have been a mainstay for a wide variety of applications and decision-making. This is changing as more spatially referenced data and information on a wider variety of topics or themes, like population, land use, economic transactions, hydrology, agriculture, climate, and soils, are being produced, stored, transferred, manipulated, and analysed in digital form. A new wave of technological innovation is allowing us to capture, store, process and display an unprecedented amount of map information about land and a wide variety of environmental and cultural phenomena associated

with it. Much of this information will be spatially referenced i.e. it will refer to some specific geographic place or have 2/3- dimension coordinates to depict its location. With the availability of satellite-based remote sensing data and the organization of spatial databases around Geographical Information System (GIS), combined with the Global Positioning System (GIS), the process of semantic spatial information system has now became a reality. The advent of GIS technology has transformed spatial data handling capabilities and made it necessary for re-examining the roles of government with respect to the supply and availability of geographic information. With GIS technology, users are known able to process maps-both individually and along with tabular data and "crunch" them together to provide a new perception – the spatial visualisation of information.

The awareness and utilisation of the GIS technology and the power of spatial information systems specially oriented towards decision making or resource management is growing rapidly in the country. A major challenge over the next decade will be to increase the use of spatially referenced data to support a wide variety of decisions at all levels of society. Using an effective, efficient, and widely accessible infrastructure, spatial data could be readily transported and easily integrated both thematically (across environmental, economic, and institutional databases) and hierarchically (from local to national and eventually too global levels). Transparent access to myriad databases could provide the information for countless applications, such as facility management, real estate transactions, taxation, land-use planning, transportation, emergency services, environmental assessment and monitoring, and research. Work on these applications could take place in schools, offices, and homes across the nation. In addition, these activities will lead to new value added services and market opportunities in fast emerging spatial information industries.

Aims of this Course

With the increasing awareness and the people's involvement in developmental planning at local level and the emergence of participatory planning will demand access to spatial information basically integrating information from disparate sources. To an increasing degree, the use of spatial information will become commonly used tool for developmental alternatives and societal choices for decision-making. Individual's demand for information-spatial and non-spatial will force the establishment of infrastructures, encompassing their immediate circle of family and society, the land that they till, the water they use, the environment around them and to a larger extent the general awareness of the world. To fulfil such a huge demand two technologies i.e. Remote Sensing and GIS are available. Effective utilisation of such technologies depends mainly on the availability of trained manpower. To develop such trained manpower training should be aimed at transferring the tested methodology and exposing to the user departments to the present state of the art and to potential applications. Education is however, intended for future technology developers, refining research methodology and knowledge, in this direction the education institutions should provide opportunity to develop specific skills to address the following issues :

- Motivate the Policy makers, decision-makers and administrators to assess the political, social, economical and environmental implications of space science and technology.
- Support the Scientist and Engineers for developing and adopting the technology by designing application systems.
- Provide platform to educators and trainees to transfer the GIS knowledge at various levels in different areas of specialisation.

An assessment indicates that there is a need of large numbers of training institutions to train manpower on mapping, geoinformatics and spatial database generation. The estimated requirement of trained manpower annually is around 1300(Roy,P.S.2001). Out of this more than 50% may need short duration competence programmes in the above areas. There are about ten institutions in the whole country that impart training in RS-technology and GIS application and BIT is one of them. But so far no university is imparting graduate degree in GIS of its own.

To meet the supply/demand gap in the manpower requirement in the field of remote sensing and GIS, it is necessary to intensify the existing training activities in education Institutions and strengthen them.

Importance of the GIS Education

Geographical Information system (GIS) is being widely used in various fields for analysing spatial data. On one hand it helps in integrating graphic and attribute data generated through remote sensing, thematic maps, field collection etc., while on the other, it allows spatial model building including multi overlay operation for decision support system.

No science and technique has grown so fast as Geography Information Science and Technology . It can be seen through the estimated expedites for currant year i.e. $ 34 billion (Gary Hunter & Clifford Ogelby,2002). The shortage of qualified graduates in the area of GIS is becoming move acute hence companies are employing even those who has done short and medium term training to a particular software. But these kind of manpower can only create GIS data base and are not able to design the basic framework of GIS required by the client. Even in most cases client is also happy to see his data in vector or raster mode on the computer screen but beyond this he /she also fails to utilize it because of the lack of knowledge in this field. To over come this problems I want to draw attention of the technical Institutions to come forward and prepare a common Under Graduate and Post Graduate Course of GIS so that we can produce the right kind of human resource who are technically sound in this science and can contribute their skill for the over all development work and to develop decision Support System.

This can only be achieved when these skilled pools of manpower think uniformly. For this, they should be able to explore each & every aspect of this technique. This can be possible when we have a universally accepted common course curriculum like other mainstreams professional degree courses. We made an attempt in this direction as we designed one M.Tech course in GIS which will be started by our university from January 2003. Though it is difficult to cover all of its contents in one course, but keeping to the demand of the industries we tried to accommodate the maximum topics related and required by them so that students can get easy entry in the industry and in academic institutions . This course will serve these purpose:

- Firstly –Industry will get technically sound resource persons who can think geographically as well as able to develop DSS.

- Secondly- Many Institutes are coming forward to introduce GIS as an elective in their main stream branches like Geology, Geography, Civil Engineering, Architecture, Urban & Regional planning, Forestry, Agriculture, Soil etc. The list is endless. These Institutions will also get qualified manpower to teach these electives.

- Thirdly – Such skilled personnel are required at all Govt. sectors at Central, State and Local level in various ministries as well as PSU's, so that this technique can be utilised fully for better G-governance.

Proposed M.Tech. Geographic Information Systems Course

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Looking to the increasing applications of Remote sensing techniques, Geographic Information system (GIS) and global Positioning System (GPS) in various activities including resource evaluation, environmental monitoring and landuse/ landcover mapping etc., for generation of accurate information system for plan formulation at all levels, an Essential pre-

requisite to partaking in these opportunities is the building of various indigenous capacities for the development and utilization of Space Science and GIS technology. This has led to a spurt in the demand for qualified manpower. Keeping this in view, a two-year duration M.Tech. Program in GIS is designed by us at BIT. The duration of the Course is two year's which will be covered in four semesters.

M.Tech. GIS Course Structure

Course No.	Title	Units
	1st semester	
GIS 1001	Principles of Geographic Information Sciences	1
GIS 1002	Principles of Remote sensing	1
GIS 1003	Essential Cartography for GIS	1
GIS 1004	Computer Fundamentals & Data Structure	1
GIS 1005	Computer Graphics Applications	1
GIS-P 101	GIS Lab.	.5
GIS-P 102	Computer Lab.	.5
		6
	2nd Semester	
GIS 2001	Global Positioning system & Internet GIS	1
GIS 2002	Digital Image Processing	1
GIS 2003	Programming in VB & C++	1
GIS 20*	Elective-I	1
GIS 20*	Elective-II	1
GIS-P 201	GIS Lab.	.5
GIS-P 202	DIP Lab.	.5
		6
	3rd Semester	
GIS 3001	Research Methods & Spatial Analysis in GIS	1
GIS 3002	GIS Project Management	1
GIS-S301	Pre Thesis Seminar	4
		6
GIS-4001	4th Semester	6
		24

20*Electives to be chosen from a list of 12 applied fields

Conclusion

This article illustrates an attempt made by the Department of Remote Sensing, BIT to develop a post graduate course in GIS. This course will fill a vacuum in this region and will able to produce skilled manpower capable to take any challenge in the field of GIS. We tried to integrate basics of Geography, Cartography, Computer Science, Remote Sensing & GPS so that a person graduating this course gets a broad knowledge of GI Science as well as is able to manage GIS Projects independently. We will welcome all suggestion to add value in it from this august gathering of Scientific Community in general and GIS Industries in particular.

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