
Khadri, S.F.R Chaitanya Pande and Kanak Moharir
Department of Geology, Sant Gadge Baba Amravati University, Amravati-444602 (MS)
email:syedkhadri_62@yahoo.com

Abstract:
GIS is widely used as tools to digitize remotely sensed or cartographic data complemented with various ground-truth data, which are geo-coded using a global positioning system (GPS). GIS can be used to analyze the spatial characteristics of the data over various digital layers. If sequential data are available quantification of spatial changes becomes possible through overlay analysis. GIS is an expanding information technology for creating databases with spatial information, which can be applied to both human settlements (e.g. demographic databases) and to the natural environment (e.g. distribution of populations and environmental factors). Most importantly, the combination of both types of database can ensure sustainable management. Population acts on land through a spectrum of activities, which can be broadly classified as agricultural, commercial, industrial, residential, transportation, administration etc. This study demonstrates the use of high-resolution satellite data in generating spatial data on the image for the city. Road patterns within the city are analyzed and road network map is generated. Cities and towns are undergoing unplanned and uncontrolled growth due to rapid urbanization, which lead to changes in land use pattern and transportation network. Also lack of infrastructure facilities and utilities has been a growing problem in urban areas. Creation of additional infrastructure in tune with the increasing population is essential for improved resource management and better living conditions. RS has provided and important source of data for urban infrastructure and transportation system planning, monitoring and implementation, mapping individual settlements and internal roads, urban complexes, urban utilities and urban land use mapping.

Keywords: - Land Use, Urban, Remote Sensing, GIS, Mapping, Planning.

Introduction
GIS is widely used as tools to digitize remotely sensed or cartographic data complemented with various ground-truth data, which are geo-coded using a global positioning system (GPS). GIS can be used to analyze the spatial characteristics of the data over various digital layers. The city is located at 19°51' and 21°16' latitude and 76°38' and 77°44' longitude, covering an area of 100 Sq.Kms, at present city consists of 72 municipal wards in Akola city. Population acts on land through a spectrum of activities, which can be broadly classified as agricultural, commercial, industrial, residential, transportation, administration etc. The administrators of city or a town adopt two approaches to evaluate the urban places and the impact of urbanization. The first approach undertakes the study of size, function, growth rate, and tributary area of cities in the general fabric of settlements. The second approach deals with the internal structure of cities and the related factors, which control the layout and buildings, the character and intensity of land use, the movement of persons and goods between various functional areas. The land use planning is a part of larger process of city planning. It is basically concerned with location, intensity, and amount of land development required from various space using functions of city life, such as, industry, wholesaling business, housing, recreation, education, and religious and cultural activities of the people. Cities and towns are undergoing unplanned and uncontrolled growth due to rapid urbanization, which lead to changes in land use pattern and transportation network. Also lack of infrastructure facilities and utilities has been a growing problem in urban areas. Creation of additional infrastructure in tune with the increasing population is essential for improved resource management and better
living conditions. RS has provided and important source of data for urban infrastructure and transportation system planning, monitoring and implementation, mapping individual settlements and internal roads, urban complexes, urban utilities and urban land use mapping. RS and GIS technologies together provide an efficient and cost-effective means of managing day-to-day activities of town planning, transportation engineering, facilities management, taxation and good governance. RS and GIS Applications Area have expertise in the following areas:

- Master/ Development plan preparation
- Infrastructure/ Facility mapping
- Urban information system
- Cultural resources management studies
- Urban sprawl mapping
- Growth centre/SEZ analysis

Study Area

The Akola city is located at 19°51' and 21°16' latitude and 76°38' and 77°44' longitude, covering an area of 100 Sq. Kms, at present city Consists of 72 municipal wards in Akola city. Population acts on land through a spectrum of activities, which can be broadly classified as agricultural, commercial, industrial, residential, transportation, administration etc. This paper helps in correlation phenomena, identifying zones of inadequacy and inadequacies in the city system of Akola. The administrators in the city can evolve an expert of a decision support system aimed at for various decision-making processes.
Methodology:-

Data Used:-

Data required is as follows:
2. Municipal Map of Akola District,
3. Open Source IRS LISS-III Satellite Image,
4. Census Data,
5. Police Station Service Location in urban planning.
6. Health Location Service Location in urban planning.
7. Educational and Bank Service Location in urban planning.

Tools Used:-

- ESRI Arc GIS 9.3.1.
- ERDAS 9.1
- Google earth
- Global Positioning System (GPS)
- Microsoft office tools

- Arc GIS was used for the Digitization, Map layouts.

Fig. 2 Flow Chart for Urban Planning
According to 2001 India census, Akola district has a population of around 16,30,239. Number of males is about 8,41,253 whereas female population is about 7,88,986, whereas the population of Akola city is around 6,27,497 in that the total Male population is 3,23,788 and Female population is 3,03,709. The literacy of Akola city is 4,63,158 in this the Male literacy is 2,52,750 and Female literacy is 2,10,408.
Geo-referencing

Correlating the image to the real world co-ordinate with a specific Projection and specified units is called geo-referencing. Unless and until images are geo-referenced, they cannot be arranged sequentially or overlaid one upon another for any further analysis. Rough geo-referencing can be done with the help of addresses (lat, long) given the accompanied data of image for four corner pixel and one central pixel. For refined geo-referencing, a projected Map can be used while rectification of image and can be transformed specific projection of that map with the specific datum and unit.
Digitization

Digitization is the process of conversion of raster data into vector data. Various vector layers were generated in the First stage.

First Stage:-

➢ In this the road layer is digitized in line features from satellite image or Google earth.
➢ In this the building layer is digitized in polygon features from satellite image or Google earth.
➢ Police station locations, Educational location, Bank location, Market location, slums, Hospitals and layer are digitized in polygon features.
➢ River area, Akola Municipal Boundary and Akola Ward Boundary are digitized in polygon features.

Second Stage:-

In the second stage map editing and topology of various layers were generated.

Road Layer:-

Following procedures were followed to generate the road layer

➢ Digitization of the road layers from the Google earth and satellite image of Akola.

![Road Network Map of Akola](image)

Fig. 7 Road Network Map of Akola

After the digitization of road network from the satellite image there is building of topology is done.

➢ Topology building of the road layer.
➢ Assigning the names to the roads.
➢ Built up road network.

This was followed by the road network editing and rebuilding the topology for the road network analysis.
Third Stage:-
The third stage includes analysis works

Urban Planning:-

- Based on the urban planning of various indentify like bank, medical center, police station, slum, market area, educational service etc is done.
- In this study is prepared of land use/ land in urban area and measures changes in urban area of Akola city.
- In this various map is prepared such market area, educational service map, bank service map, police station service map etc.

Image Interpretation Process

This process consists of a set of image elements or characteristics like color, tone, texture, pattern, size, and shape which help in the recognition of various land use/land cover classes systematically on the enhanced fused satellite imagery during interpretation process. A preliminary image classification key is prepared for classifications of surface features. This is then finalized after the ground truth. Using the image interpretation key, preliminary interpretation is carried on Sol Toposheets available on 1:50,000 scale and a base map is prepared. Based on this map, the fused product (Fig. 9) is used and interpretation key for classification of land use/land cover patterns and 16 different patterns/classes categories are identified and marked on the image and validated during the subsequent field work conducted during the project. The doubtful areas (due to similar spectral response and spectral signature) identified during the preliminary image classification are listed out before ground verification. After final Sing the ground traverse plan, the doubtful areas are noted. Based on the ground information collected, corrections and modifications of misclassified land use/land cover details and doubtful areas were carried out on enhanced imageries for final land use/land cover classification. The final land use / land cover classes were prepared by assigning standard color with respect to land use/land cover classes. This rapid land use assessment methodology allowed us to quantify the entire area of MCA into 5 land use/land cover categories for 100 sq km area. Each one of these 5 categories or classes or patterns represents one type of feature on the MCA area.

Land Use Land Cover
In general, there is a lack of accurate, current data for urban areas in developing countries. Projects often rely on catch-as-catch-can basis, where the best available data of reasonable scale from a variety of sources is integrated. This is essentially a make-do approach. Satellite imagery is a significant alternative source of data for development and maintenance of data layers for a municipal GIS. Digital satellite data is often of overwhelming size and format for installations. The costs are also often prohibitive. Manual interpretation from hardcopy images is a valuable alternative, which requires as little image processing as possible. This technique is useful for developing land use classifications, for interpreting additional data sets, and for the development of point-based property information systems. The broad objective of the project of MCA discussed in this chapter is to prepare Municipal zone-wise land use/land cover and major road network using LISS - III Merged digital data of IRS 10 satellite on 1:25000 scale. This can be performed by Image processing of digital data with the help of ERDAS9.1 software and ARC GIS 9.3.1 software. The land use/land cover map will be used as baseline information for taking necessary decisions for the improvement of area under Municipal Corporation of Akola. Remote sensing and Geographic Information System (GIS) addresses the problems related to urban planning and management. As discussed earlier, GIS can be defined as a set of tools for collecting, storing, retrieving, transforming, and displaying geographically referenced spatial data with its corresponding attribute information. Thus a GIS has a database of multiple information layers that can be manipulated to evaluate relationships among the chosen elements in the different layers under consideration called topology, in general, and land use/land cover information system of Akola using GIS technique in particular. Basically, two types of data are to be generated along with other collateral data from different sources for desired accuracy parameters. The two types of data base are: (i) spatial database creation and (ii) non-spatial database creation (attribute data).

Fig. 9 Akola City as seen by LISS-III sensors.
Fig. 10  Land Use/Land Cover Map of Area under Municipal Corporation of Akola City (MCA) jurisdiction

Police Station Network Service Map -
Police also plays an important role in Crime analysis. They provide important help in vehicle theft, house theft, robbery or disaster. Police stations that provide Emergency response support to any incident or rescue situations. Such as City Kotwall, Ramdaspeth, Civil line, Old-City, Akot file, Khadan.

Fig. 11. Police Station Service network map
Emergency Services Location map: In the above study map of urban planning in Akola city is shown. In this map blue color has indicated Hospital Services location.

Educational Services Location map

In the above study map, the urban planning in Akola city is shown. In this map Pink color has indicated Educational Services location.

Main Market Area Location map:

In the above study map of urban planning in Akola city is shown. In this map Red color has indicated Main Market Area location.
Fig. 14. Main Market Area Location map of Akola city
Minimum Residential Area Location map
In the above study map of urban planning in Akola city is shown. In this map Sky blue color has indicated Minimum Residential Area location.

Fig. 15 Minimum Residential Area Location map of Akola city
Bank Services Location map

In the above study map of urban planning in Akola city is shown. In this map Darkumber color has indicated Bank Services location.

Fig. 16  Bank Services Location map of Akola city

Conclusions

The primary data on which the classification procedure is based is land use/land cover, such as, forests, built-up agricultural lands, and wastelands in the project area. All these earth surface features have different spectral reflectance values. Based on this a thematic map of land use land cover is prepared. The preparation of this map is mainly based on image classification of LISS - III digital data. The two methods of digital image classification are Supervised Classification and Unsupervised Classification. This process consists of a set of image elements or characteristics like color tone, texture, pattern, size, and shape which help in the recognition of various land use/land cover classes systematically on the enhanced fused satellite imagery during interpretation process. A preliminary image classification key is prepared for classifications of surface features. This is then finalized after the ground truth. Using the image interpretation key, preliminary interpretation is carried on Sol Toposheets available on 1:50,000 scale and a base map is prepared. All the various schools in the city could fine place either in the new city. Likewise, number of Collages and training institutions of outside and center of the Akola city. The location of educational institutions and hospitals inside the Akola city has resulted in increased in traffic due to movement of people between old and new city to avail of these facilities. During the peak hours, weather it is in the morning or in the evening (9AM-11AM and 4PM-8PM), the traffic movement is witnessed unidirectional. Thus, the Akola city has undergone functional and spatial change. It is not the matter of traffic alone but the inhabitants of the Bus stand, civil lines, etc face difficulties because of non-availability of required number of
medical and health and educational institutions in the Akola city. Hence education and emergency services are mapped on IRS (LISS-III) data; Map Crime mapping can help police protect citizens more effectively. Simple maps that display the locations where crimes or concentrations of crimes have occurred can be used to help direct patrols to places they are most needed. Urban growth is taking new forms characterized by heavy dependence on transportation, communication and multiple activity centers. It becomes necessary to understand the mechanisms at play to capture aspects associated with this complex process to develop frame works in the context of increasing importance of a National Urban System. The type of urban growth proliferation that witnessed today calls for policy orientations that will not only contain the parasitical tendencies of metropolitan growth but also integrate growth of lower order settlements with development of metropolitan areas. In this study an attempt have been made to employ recent tools and techniques associated with RS and GIS to verify a growth strategy formulated to contain metropolitan dominance and the problems associated with such phenomenon. Appropriate land use structures and compatible transport network are generated using remotely sensed data in a GIS environment.

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