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Geo-informatics Based Land Use / Land Cover Analysis of Chandigarh City

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Abstract: ***Urban Land use study is important for urban planning and management. Urban areas are facing serious problem of land use management because the knowledge of land use pattern helps to develop strategies to balance the conservation & developmental pressure on urban land resources. This study demonstrates the potential of geospatial technologies as a Decision Support System (DSS) in analysing the cohesiveness of Chandigarh city. The study was carried out by using Google earth imagery of 2010 using on screen visual analysis of land use pattern. The land use features were prepared in Arc GIS vector form which is used for identifying the various classes of urban land use. The result shows that Chandigarh being a planned city has 36 percent under residential purpose and in this area under built up is only 10 percent and rest 25 percent is open areas within built up land. The both commercial & industrial land use categories equally covers less than three percent each and area under vacant land and forest cover about 12percent and 6 percent respectively. It is evident from study that even being a planned city it is facing number of problems like roads & parking, slums, pollution and lack of infrastructure and requirement of spatial expansion for different land uses to meet the continuous increasing demand of increasing population.***

Keywords: Remote Sensing, GIS, Land Use/Land Cover

1. Introduction

The modern technology of remote sensing includes both aerial as well as satellite based systems, allow us to collect a lot of physical data easily with speed and on repetitive basis and together with GIS helps us to analyse the data spatially, offering possibilities of generating multiple options, thereby optimizing the whole planning process. These information system also offers interpretation of physical (spatial) data with socio-economic data, and thereby providing an important linkage in the total planning process and making it more effective and meaningful.(Ravindra Kumar Verma1,et.al.)[1]The purpose of the study is to shows the role of geospatial technology in planning of Chandigarh city. With the help of this technology the land use and land cover patterns have been categorized namely; built up areas, agriculture land, waste land, forest, open spaces, water bodies and transportation etc. This technology cost effective, less time consuming and gives the accurate result by updating temporal database. There is increasing trend in using space technology data in urban areas land use planning and management in recent decade (Tuyahov et al., 1973 [2]; Jensen, 1983[3]; Haack et al., 1997[4]). In an early attempt to relate remotely sensed reflectance to socio- economic parameters, Forster (1983) [5] devised a classification scheme for Landsat imagery that could be applied to urban areas to produce a residential quality index. Remote sensing data have also been used in attempts to estimate population (Lo, 1986 [6] and 2001) [7] and quantify urban growth and land use (Mesev et al., 1995[8]; Stehanov et al., 2001) [9]. Welch (1982) [10] conducted a resolution analysis of satellite sensors and demonstrated that 0.5 to 10 m spatial resolution is necessary to adequately characterize urban infrastructure in most of the cities/towns. Jensen and Cowen (1999) [11] have identified a hierarchy of urban/suburban attributes that can be measured using remote sensing data. The current/near future high resolution satellite data from Cartosat-1/2, Cartosat-3, RISAT, ASTER, LANDSAT ETM in optical, microwave, infrared, thermal will begin to meet urban planning needs.

2. Objectives

- To generate exiting Land Use / Land Cover Map
- To analyse the present LULC pattern in future perspective planning.
- Generation of digital data base in GIS format for future planning needs

3. Study Area

Chandigarh city is located in the foothills of the Shivalik range and is a union territory of India that serves as the capital of two states, Punjab and Haryana as shown in location map (Fig-1).The exact geographically coordinates of Chandigarh are 30°44′N 76°47′E 30.74°N 76.79°E.It covers an area of approximately 114 km² and out of which 36 sq.km.is rural and remaining 78 Sq.km is urban. The city is divided into 55 dwelling sectors. It has an average elevation of 321 metres (1053 ft). The name Chandigarh translates as "The Fort of Chandi". The name was coined from an ancient temple called Chandi Mandir, devoted to the Hindu Goddess Chandi, present in the city's vicinity. It is occasionally referred to as The City Beautiful and also as the first planned city of India, Chandigarh is known internationally for its architecture and urban planning. Chandigarh is home to numerous architectural projects of city planner LeCorbusier, PierreJeanneret, MatthewNowicki, and Albert Mayer. The city tops the list of Indian States and Union Territories with the highest per capita income in the country at Rs.99, 262 at current prices

and Rs.70, 361 at constant prices (2006–2007). As per a study conducted by Ministry of Urban Development, Chandigarh has emerged as the cleanest city in India [12].

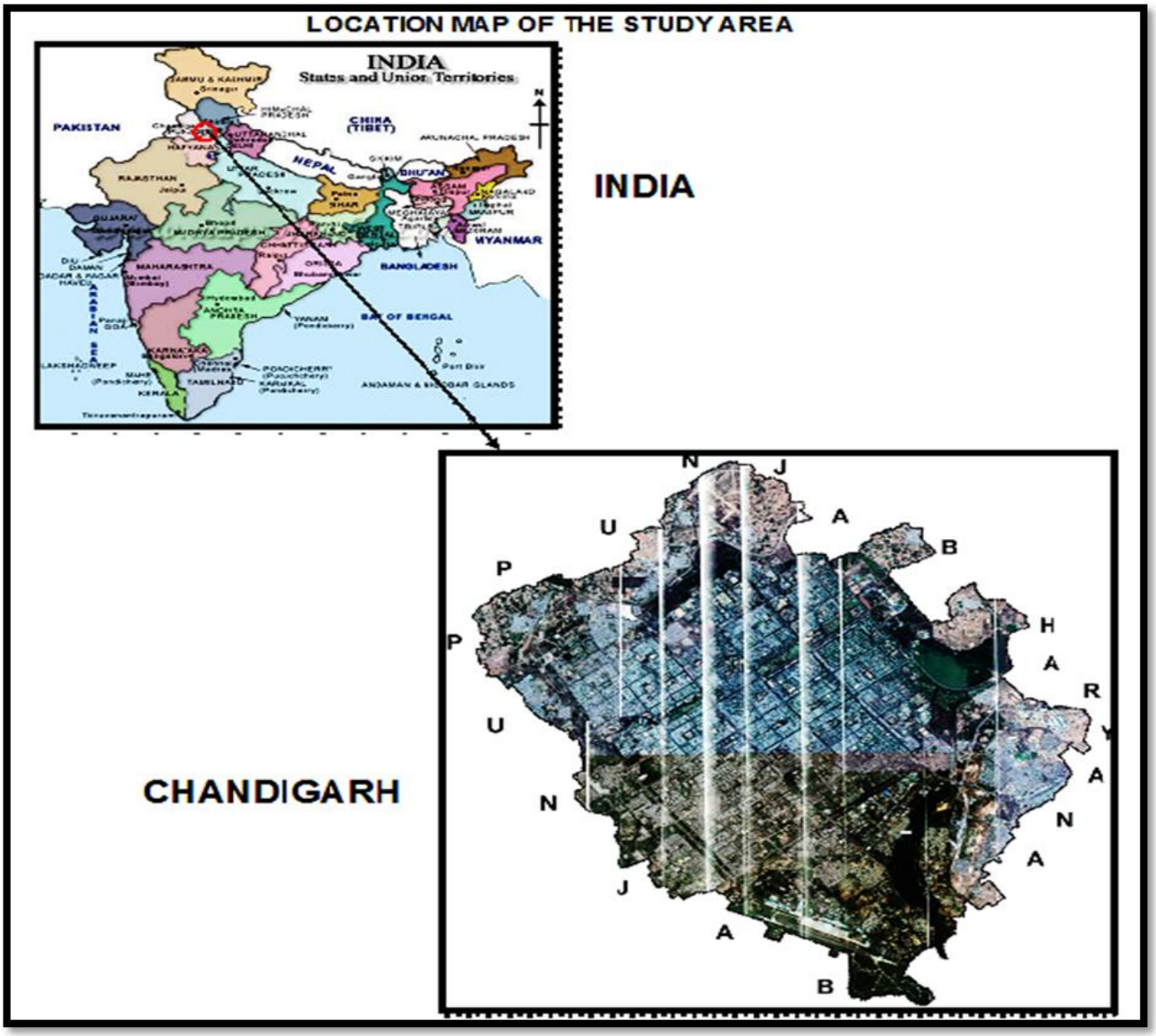

Figure 1: Showing Location maps of the Study Area

4. Material and Methodology

a) Primary Data

Google Earth satellite data of year 2010 have been used for the study purpose. Google Earth displays satellite images of varying resolution of the Earth's surface, allowing users to see things like cities and houses looking perpendicularly down or at an oblique angle. In this study satellite imagery is used for preparation of base map by downloading and mosaicing the images from Google earth.

b) Secondary data

Survey of India (SOI) Toposheets nos 53B/13, 53B/14 on 1:50,000 scales were used in study. As name suggests toposheet gives the information about the topographical condition of the surface and also contains information about roads, railways, settlements, canals, rivers, electric poles, post offices etc. These were used for demarcating the study area outer boundary.

c) Methodology

The study area images were geo-referenced which means assigning coordinates to map & transforming raster image to input coordinates system which enables viewing, querying & analysing the satellite data. On the basis of brief reconnaissance survey and additional information from previous research in the study area the land use classification was developed in broad purview of Anderson classification (Anderson et al 1976) [13]. After that on screen interpretation process was performed on imagery. It was based on the standard visual interpretation elements such as shape, size, colour, tone, texture, pattern and association. The interpreted thematic layers accuracy was verified during field visit. It is important in order to relate image data to real features and materials on the ground and doubtful areas were checked and modifications were carried as per ground verification. Finally land use/land cover (LULC) map was prepared. As shown in the

methodology flow chart has been give below for easy and better understanding of the procedure adopted (Fig-2)

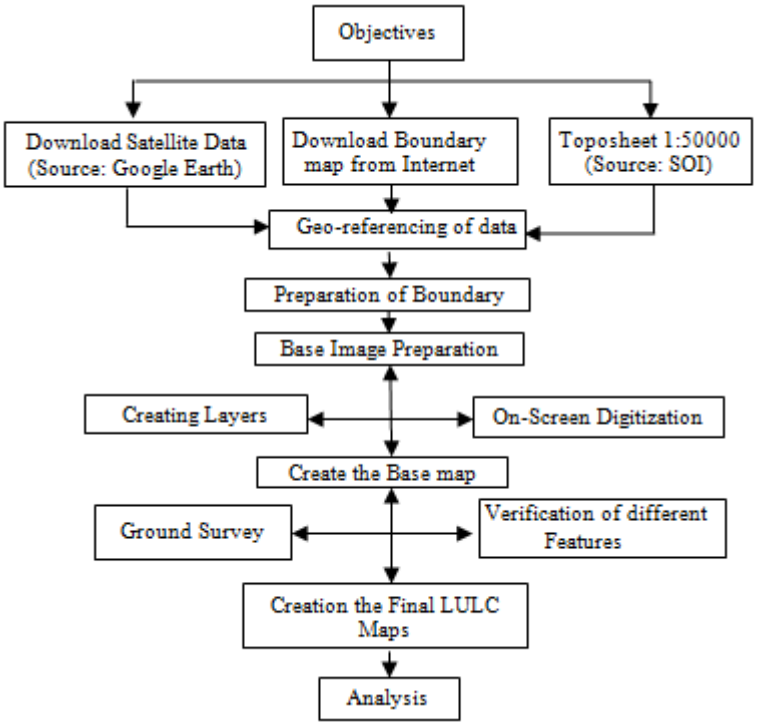

Figure 2: Showing Methodology Chart Of Present Study

5. Result & Discussion

Land use is the human utilization of land. It involves the management and modification of natural environment or wilderness into built environment such as fields, pastures, and settlements. It has also been defined as "the arrangements, activities and inputs people undertake in a certain land cover type to produce, change or maintain it .The study area is having total geographical area of 28521.66 acres in which different land uses are categorized into such as residential, industrial, commercial, public-semi-public, open spaces, play ground, public utilities, area under construction, drainage & water bodies, agricultural land, forest land, vacant land, roads and parking etc. Further these broad land uses categorized into sub land uses as residential built up and residential open within built up etc, as showing in Fig-3 and table -2. Detailed about each classes of LULC given below:

Table 2: Showing existing Land Use of the Study Area

Sr. No	Land Uses	Area in Acres	Percent
1	**Residential**	**10467.35**	**36.7**
	Built up	*3096.83*	*10.86*
	Open within Built Up	*7370.52*	*25.84*
2	**Commercial**	**788.02**	**2.76**
	Built up	*230.72*	*0.81*
	Open within Built Up(parking, pavements)	*557.3*	*1.95*
3	**Industrial**	**727.19**	**2.55**
	Built up	*205.04*	*0.72*
	Open within Built Up	*522.15*	*1.83*
4	**Public and Semi-Public**	**2186.96**	**7.67**
	Built up	*288.52*	*1.01*
	Open within Built Up	*1898.44*	*6.66*
5	**Public utilities and Under Construction**	**182.54**	**0.64**
6	**Drainage and Water Bodies**	**923.03**	**3.24**
7	**Agriculture Land**	**2481.4**	**8.70**
8	**Forest**	**1667.55**	**5.85**
9	**Open Spaces and Play Ground**	**3593.29**	**12.60**
10	**Vacant Land**	**3322.54**	**11.65**
11	**Area Under Roads and Parking**	**2181.79**	**7.65**
Total Area		**28521.66**	**100.00**

The Residential area is spread over 10467.35 acres that is 36.7 percent out of total study area as shown table 2 and fig-3. Out of these 3096.83 acres is built up and 7370.52 acres is open within built up. The city has limited land therefore, she cannot afford further horizontal expansion and the vertical expansion is only viable alternatives to meet the residential demand. The area under Commercial land use class is 788.02 acres (2.76%) and in which 230.72 acres is built up and 557.3 acres is open within built up. It is suggested that already developed commercial areas should be encouraged for vertical growth. The Industrial area occupies 788.02 acres (2.55%) and in this category 205.04 acres is built up and 522.15 acres open within built up. The demand of land for industry is also increasing. The Industrial area of phase –I, II& III is located south east side of city. In year 2005 government allow to conversion of land use from commercial to industrial for revitalizing the area. The poor development of industrial area is due to inadequate infrastructure like water supply, sewage system and power. Due to mixing of industrial and commercial land use category has created traffic and transportation problem. Now, a comprehensive urban renewal plan is required immediately for industrial area. As Shown in Fig -3&4.The public/semi-public land use class covers the total area 2186.96 acres (7.67%) and in 288.52 acres is

built up and 1898.44 acres under open within built up. This category included with all government offices, institutional and hospitals etc. The public utilities and area under construction land use category occupies very small is only 182.54 acres (0.66%). Drainage & water bodies land use class covers 923.03 acres (3.24%). This category included all water bodies (lake, ponds and water tank natural and manmade), sewerage and river channel etc. The agriculture land use class covers 2481.4 acres (8.70%) of TGA. Area under forest is 1667.55 acres (5.85%). The vacant land should bring under forest plantation to maintain ecological balance the study area. The open space and play ground land use area is 3593.29 acres (12.60%). This open space includes with play ground and all parks. The category under vacant land use is 11.65% of total area and due to ever increasing demand of all developmental needs on limited open spaces is heavily pressurised. Therefore, these are should be judiciously used. Area under roads and Parking covers 7.65 percent of total study area. In study area there is no scope of expansion of roads and increasing demand of parking areas can be met only by constructing a number of floors under the ground.

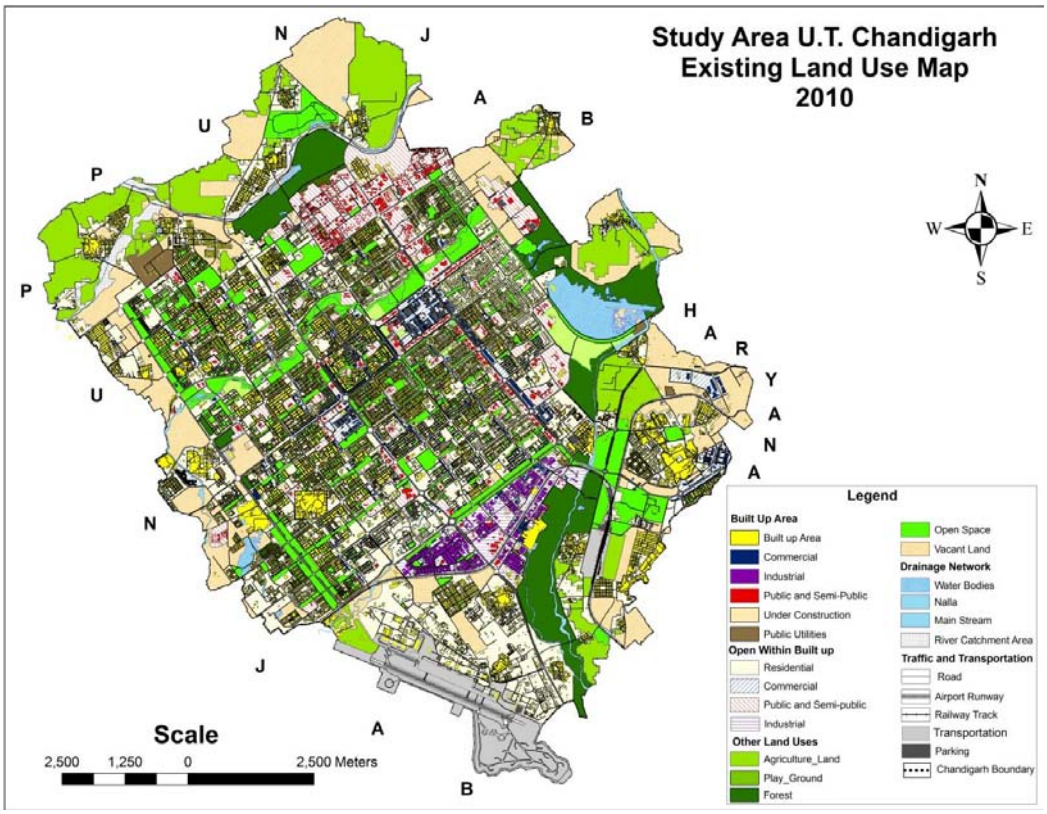

Figure 3: Distribution of Land use Study area

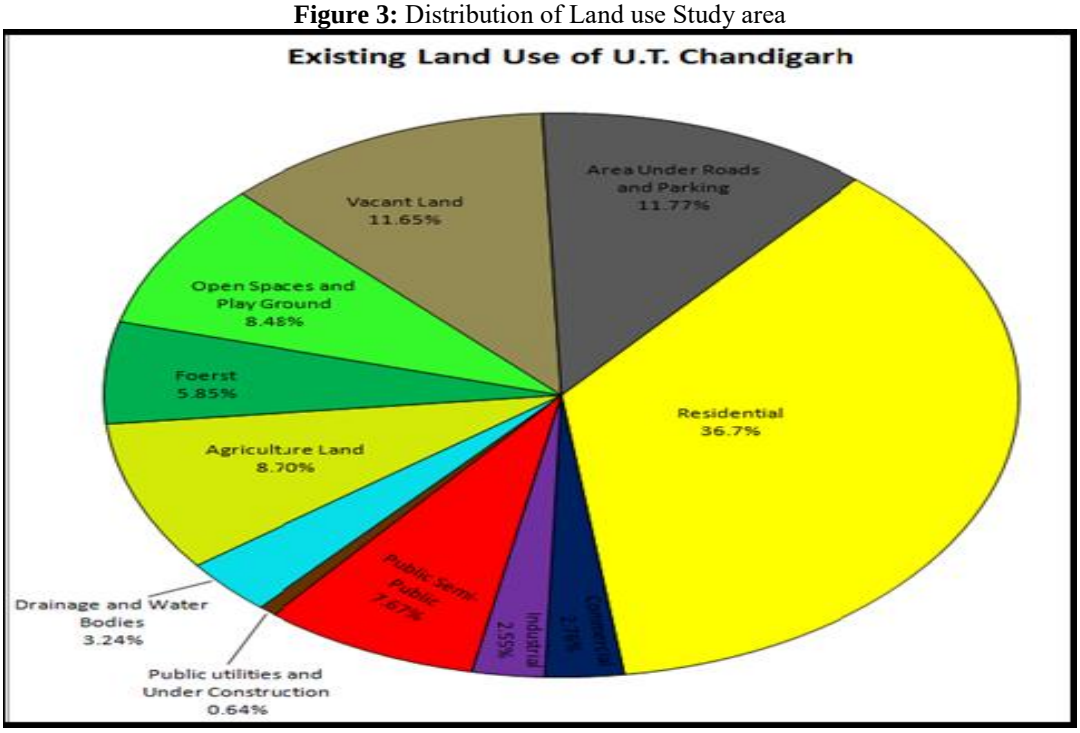

Figure 4: Existing Land use Study area

6. Conclusions

In this study shows the vital role is played by geospatial technology in current urban planning and management. It is tool to know the existing land use and infrastructure. This technology helps the city planner to identify the problems and their possible solutions of the urban area and a great help to prepare land use plan of cities. The following conclusions have been derived in Chandigarh.

1) There is no land for expansion the roads in the future.
2) Greens area is degraded.
3) In some part of Chandigarh, Drainage system is not maintained. Storm water of households directly falls in Sukhna choe and Patiala Ki Rao Choe. These are serious the unhygienic condition of city and it will be a cause of environment pollution and will do great harm to groundwater.
4) Slums are spreading on open and vacant areas and are a stigma to city beautiful.
5) There are 12 percent area is vacant which need to use judiciously for future development.

References

[1] Ravinder Kumar Verma, Sangeeta Kumari and RK Tiwari, *Application of Remote Sensing and GIS Technique for Efficient Urban Planning in India* , - Geomatrix Conference , 2009 - csre.iitb.ac.in
[2] Tuyahov AJ, Davies CS and HolzRK, 1973, Detection of urban blight using remote sensing techniques, Remote Sensing Earth Resources, 2: 213–226.
[3] Jensen JR, 1983, Urban/suburban land use analysis, *Manual of Remote Sensing*, second ed. ASP, Falls Church,1571– 1666.
[4] Haack B, Guptill S, Holz R, Jampoler S, Jensen J and Welch R, 1997, Urban analysis and planning, *Manual of*
Photographic Interpretation, ASPRS, Bethesda.
[5] Forster B, 1983, some urban measurements from Landsat data, Photogrammetry Engineering and Remote Sensing, 49: 1707- 1716.
[6] Lo CP, 1986, Accuracy of population estimation from medium-scale aerial-photography, *Photogrammetry Engineering* and Remote Sensensing, 52(12): 1859–1869
[7] Lo CP, 2001, Modeling the population of China using DMSP operational linescan system nighttime data, *Photogrammetry* Engineering and Remote Sensing, 67(9) : 1037–1047.
[8] Mesev TV and Longley PA, 1995, Morphology from imagery— detecting and measuring the density of urban land-use, Environmental Planning, 27(5) : 759–780.
[9] Stefanov WL, Ramsey MS and Christensen PR, 2001, Monitoring urban land cover change: an expert system approach to land cover classification of semiarid to arid urban centers, *Remote Sensing of Environment*, 77 (2): 173–185.
[10] Welch R, 1982, Spatial resolution requirements for urban studies, *International Journal of Remote Sensing*, 3(2) :139–146
[11] John R. Jensen and Dave C. Cowen , Remote Sensing of Urban/Suburban Infrastructure and Socio-Economic Attribute, Photogrammetric Engineering & Remote Sensing, Vol. 65, No. 5, May 1999, pp. 611-622.
[12] Govt. of India, 1988, Report of National Commission on Urbanization, Volume- VI, Published by Govt. of India. MUA&E, 1996m, UDPFI guidelines, I: 1-253.
[13] Anderson, J.R., Hardy, E.E., Roach, J.T., & Witmer, R. E., 1976, A Land Use and Land Cover Classification System for Use with Remote Sensor Data. Geological Survey Professional Paper 964. A revision of the land use classification system as presented in U.S. Geological Survey Circular 671, United States Printing Office Washington
[14] www.censusindia.net
[15] http://www.interenvironment.org/cipa/urbanization.net
[16] http://www. GISdevelopment.net
[17] http://en.wikipedia.org/wiki/Regional_planning