Urban Sprawl Mapping and Land use Change Analysis Using Remote Sensing and GIS

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Abstract— This paper examines the use of Remote Sensing and GIS in mapping of urban sprawl variation of different years and landuse /landcover change detection So as to detect major changes that has been taken place between two different periods. Subsequently, an attempt was made at projecting the observed urban built-up due to increase in population .For advanced ecosystem management Remote sensing and GIS are now providing new tools. The data which is collected remotely facilitates the synoptic analysis of earth's system function patterning and change at local, regional and global scales.

In order to use the land optimally and to provide as input data in modeling studies, it is not only necessary to have information on existing land use/ landcover but also the capability to monitor the dynamics of land use resulting out of changing demands.. Toposheets is used for reference but are generally outdated and too coarse for detailed analysis. With the advances in software technology and availability of imagery, satellite remote sensing is being used for higher studies particularly at the landscape level. The input data used in this work is satellite image (Resource Sat 2) with LISS 4 Sensor, and SOI toposheet. The methodology adopted for this thesis is total enumerated through digital analysis which was carried out with the help of Erdas Imagine and GIS software.

Index Terms— Remote Sensing, Geographical Information System (GIS), Urban Sprawl, Land Use Change Detection, Prediction of Population and Urban area growth, image, Imagine Erdas, GIS, SOI LU/LC, satellite.

1 INTRODUCTION

Land use refers to "man's activities and various uses, which are carried on land such as settlements, industry, agriculture, etc". Land cover refers to the material present e.g. vegetation, water bodies, rocks/soils and other resulting from land transformations. Although land use is generally inferred based on the cover, yet both the terms land use and land cover being closely related are interchangeable [1].

Change detection shows the various changes occurred at certain areas ie one of the landscape ecological aims. Preparing landscape maps which shows the comparison of two decades maps can help to identify the change. Land is the most important natural resources on which all activities are based. Land use unlikely geology, is seasonally dynamic and indeed is more changing [2]. All forestry productions and agricultural animals depend on productivity of the land [3].

For efficient planning and management, the classified data in a timely manner, in order to get the classified data of the ground; satellites are the best resources to provide the data in a timely manner [4].Therefore at attempt will be made in this study to map out the status of land use/ land cover of the Hyderabad between 2005 and 2015 with a view to detecting the land consumption rate and the changes that has taken place in this status.

Spatial patterns of land use/cover over different time periods in particular can be systematically mapped, monitored and accurately assessed from Satellite data accompanied with conventional ground data [5] Particularly in their built-up land. So as to predict possible changes that might take place in this status in the next 10 years using both Geographic Information System and Remote Sensing data

2 STUDY AREA & DATA USED

2.1 Objectctive of the Project: The aims of the this study is to produce a land use/ land cover map of Hyderabad at different year in order to detect changes that have taken place particularly in the built-up land to analyze the urban sprawl of the different time period.

- The objectives of the study is to analyze the urban sprawl of Hyderabad city.
- To monitor urban land use land cover change between2005-2010-2015.

2.2 Study Area

The study area is located in Hyderabad with Coordinates of Hyderabad in degrees and decimal minutes

- The Study area is located in near Yemnampet Central Part of the Deccan Plateau and lies between 17° 24' and 17° 27' of North Latitude and 78° 38' and 78° 41' of East Longitude and is shown in meta data
- AOI:- 10.369 Sq mi as shown in Fig-1 Metadata

2.3 Input Data Used

- Satellite Image ie (Resource Sat 2) with LISS 4 Sensor,
- SOI toposheet

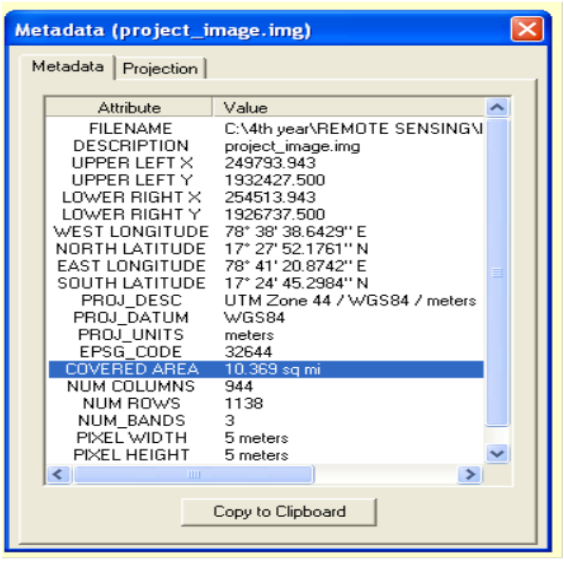
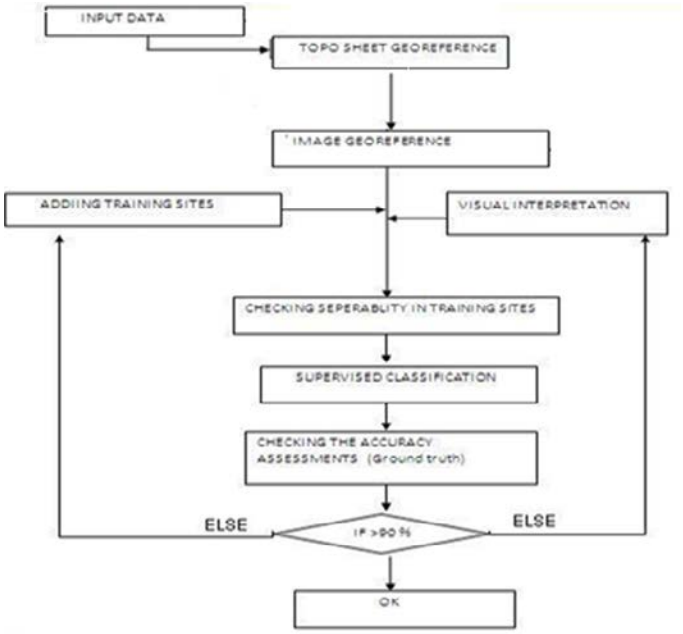


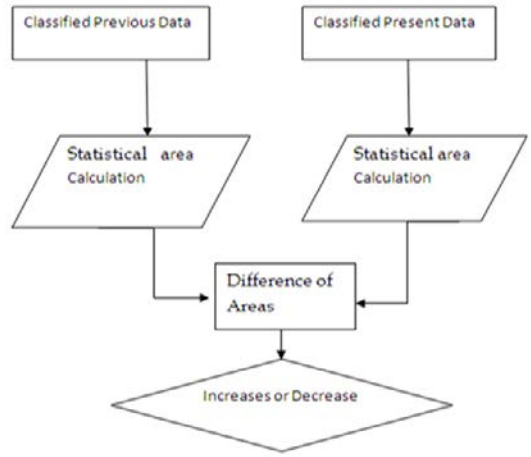
Fig-1 Meta Data

3 METHODOLOGY

Toposheets of scale 1:50,000 are scanned for the identify the features in the study area. The topo sheet is geo-referenced based wrt longitudinal & latitudinal co-ordinates. It was superimposed on the original georeferenced image for cross check and to Visual image analysis technology by selecting the training sets and creating the signature files as shown in the figure below. Respective class is given with color code. Input and output options are filled wrt other parameters and classified file is generated. **Flow chart 1 & 2** as shown above



flow chart 1:-Supervised Classification



Flow chart 2: Change Detection

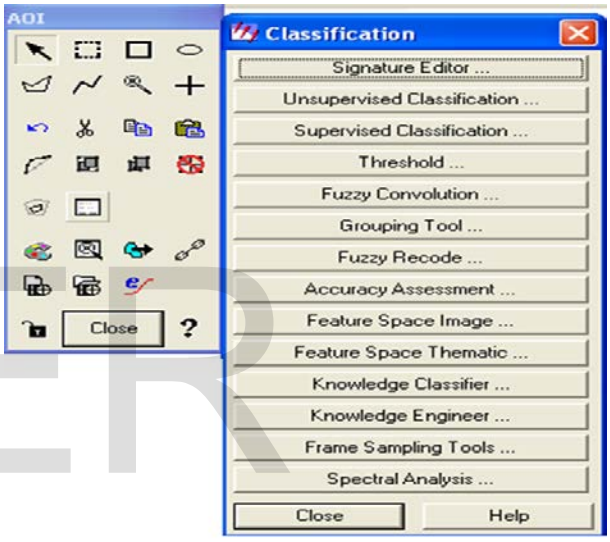


Fig-4:
Signature file

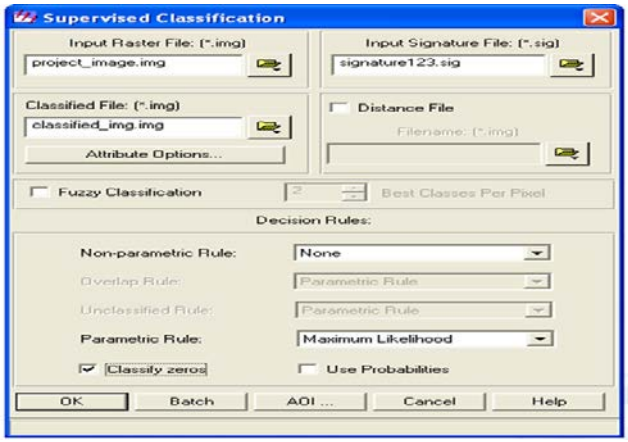


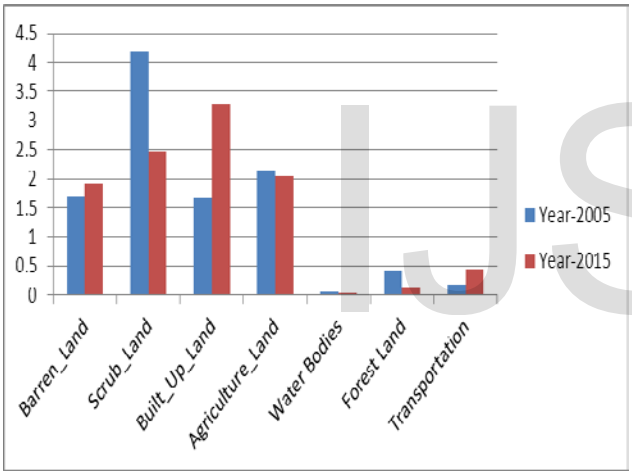
Fig-5: Supervised Classification

RESULT ANALYSIS

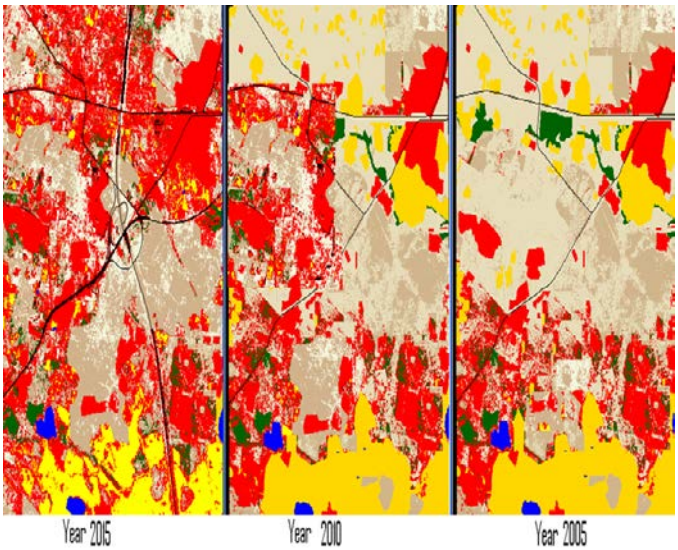
The results obtained from the classified as shown in the figure. The comparison between the identified features gives the changes. Here we compared statics 10 years difference ie 2005 and 2015.

Class	Year-2005	Year-2015	Variation	% Inc/Dec
Barren Land	1.699302	1.921359	0.22205691	2.149631
Scrub land	4.195056	2.471959	-1.7230973	-16.6805
Built_Up_Land	1.684911	3.282158	1.59724735	15.46222
Agriculture Land	2.135965	2.041458	-0.0945064	-0.91487
Water Bodies	0.052027	0.037713	-0.0143147	-0.13857
Forest Land	0.394336	0.13778	-0.2565551	-2.48359
Transportation	0.168736	0.446458	0.2777215	2.688495

Table-1: Result Analysis shown in Percentage (%)

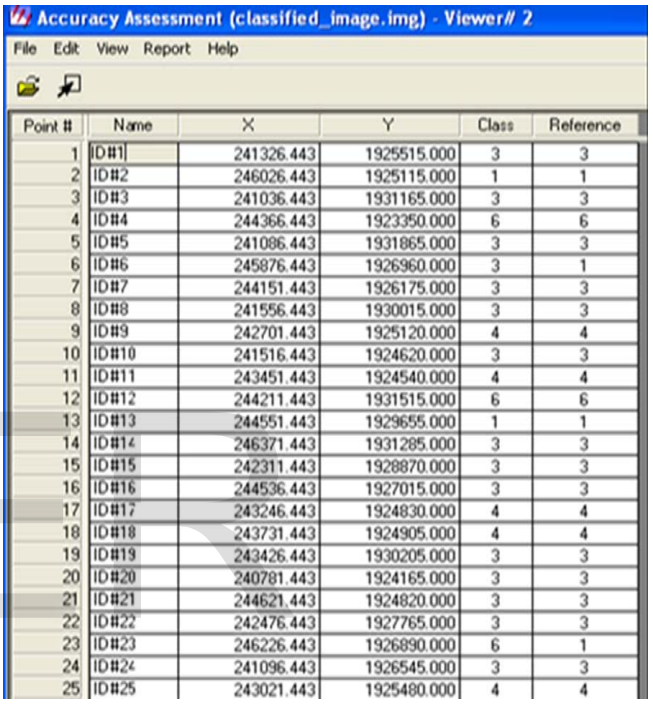


Graph:- Comparisions of Different Years



ACCURACY ASSESSMENT

The accuracy assessment is calculated by taking a hard copy of classified print out which contains GCP coordinates which gives the x, y locations of the particular features. These sheets are taken to the field survey and checked with a particular feature is existing wrt to the same lat/long values. If it is matches then true class value is give as demarcated in the classified file if not other class value is given as seen in the field. Thus field verification is done.



Point #	Name	X	Y	Class	Reference
1	ID#1	241326.443	1925515.000	3	3
2	ID#2	246026.443	1925115.000	1	1
3	ID#3	241036.443	1931165.000	3	3
4	ID#4	244366.443	1923350.000	6	6
5	ID#5	241086.443	1931865.000	3	3
6	ID#6	245876.443	1926960.000	3	1
7	ID#7	244151.443	1926175.000	3	3
8	ID#8	241556.443	1930015.000	3	3
9	ID#9	242701.443	1925120.000	4	4
10	ID#10	241516.443	1924620.000	3	3
11	ID#11	243451.443	1924540.000	4	4
12	ID#12	244211.443	1931515.000	6	6
13	ID#13	244551.443	1929655.000	1	1
14	ID#14	246371.443	1931285.000	3	3
15	ID#15	242311.443	1928870.000	3	3
16	ID#16	244536.443	1927015.000	3	3
17	ID#17	243246.443	1924830.000	4	4
18	ID#18	243731.443	1924905.000	4	4
19	ID#19	243426.443	1930205.000	3	3
20	ID#20	240781.443	1924165.000	3	3
21	ID#21	244621.443	1924820.000	3	3
22	ID#22	242476.443	1927765.000	3	3
23	ID#23	246226.443	1926890.000	6	1
24	ID#24	241096.443	1926545.000	3	3
25	ID#25	243021.443	1925480.000	4	4

Table-2: GCP of accuracy assessment

Please note that math equations might need to be reformatted from the original submission for page layout reasons. This includes the possibility that some in-line equations will be made display equations to create better flow in a paragraph. If display equations do not fit in the two-column format, they will also be reformatted. Authors are strongly encouraged to ensure that equations fit in the given column width.

5.1 Report

CLASSIFICATION ACCURACY ASSESSMENT REPORT

Image File: f:/1_gnit/2016-2017/project_team_16-17-Batch/classified_image.img

User Name: admin

Date : Fri Mar 17 14:42:00 2017

ERROR MATRIX

---------- Reference Data----------

ClASSIFIED DATA

	Unclassified	Scrub_Land	Built_Up land	Barren_Land
Unclassified	0	0	0	0
• Barren_Land	0	2	0	0

• Scrub_Land	0	0	0	0
• Built_Up_Land	0	1	0	14
• Agriculture_Land	0	0	0	0
• Water Bodies	0	1	0	0
• Transportation	0	0	0	0
☐ Column Total	0	4	0	14

- Barren_Land 1.0000
- Scrub_Land 0.0000
- Built_Up_Land 0.8485
- Agriculture_Land 1.0000
- Water Bodies 0.0000
- Forest Land 0.6377
- Transportation 0.0000

----- End of Kappa Statistics -----

CLASSIFIED DATA

AGRICULTURE	WATER BODI	FOREST LAND	TRANSPORATION
• Unclassified 0	0	0	0
• Barren_Land 0	0	0	0
• Scrub_Land 0	0	0	0
• Built_Up_Land 0	0	0	0
• Agriculture_Lan 5	0	0	0
• Water Bodies 0	0	0	0
• Forest Land 0	0	2	0
• Transportation 0	0	0	0
➢ Column Total 5	0	2	0

----- End of Error Matrix -----

ACCURACY TOTALS

Class Name	Reference Totals	Classified Totals	Number Correct	Producers Accuracy	Users Accuracy
Unclassified	0	0	0	--	---
Barren_Land	4	2	2	50.00%	100.00%
Scrub_Land	0	0	0	---	---
Built_Up	14	15	14	100.00%	93.33%
Agri Land	5	5	5	100.00%	100.00%
Water Bodies	0	0	0	---	---
Forest Land	2	3	2	100.00%	66.67%
Transportation	0	0	0	---	---
Totals	25	25	23		

- Overall Classification Accuracy = 92.00%

----- End of Accuracy Totals -----

KAPPA (K^) STATISTICS

----------Overall Kappa Statistics = 0.8670

Conditional Kappa for each Category.

Class Name	Kappa
Unclassified	0.0000

6 CONCLUSION

By analyzing the results of a decade there is a decrease in scrub land, water bodies, forest lands and agriculture. The important point it was observed is that there is a drastic increment in the builtup lands, around the outer ring road lot of settlements are increased. Based on the above results there is a variation of in the urban sprawl, due to development of industrials, transportation is increased for the facilities management. The above study provides a methodology for better estimation of urban growth and population using various land uses with time. Geographical information system (GIS) and satellite images have been used in this study to provide spatial inputs and test the statistical model describing growth. The model developed in this study can be used for predicting the future land uses even when not much of old land use data is available. This is useful for the urban planning authorities in developing countries where land use data is not available regularly. GIS and Remote sensing can help a lot in monitoring urban sprawl compared toconventionaltechniques.

ACKNOWLEDGMENT

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BIOGRAPHIES

Mr.Chikatimalla Vijay Kumar, Student of GNITC, Final year B.Tech Civil Engineering. He is a Class representative (CR). He participated in Institute of Engineers, International Geospatial Form and also achieved Prize in paper/ project presentations in various colleges.

Dr. SS Manugula has B.Tech Civil Engineering (1994), M.Tech Remote Sensing, and Ph.D. in Civil Engineering; He worked as a Research Assistant (projects) in IIT Mumbai in the department of CSRE. He has 23 years of experience (As a Civil Engg, GIS Photogrammetry-Remote Sensing) worked with National & International Clients in various multinational companies. He worked as a Dy. General Manager& Head of GIS department and also holds the credit of gaining global exposure by working in Abu-Dhabi (UAE) as a client side side support, international project work.

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