Smart Utilization of Land : A Step Towards Smart City

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Abstract: **This paper includes the study of smart utilization of land and preparation of land use land cover map of the study area by using ARC-GIS software. This map shows how land use changes over past for carrying out various urban planning and management activities by utilizing Google earth images which is open source. The objective of this study is to map and assess the rate of change. Land use land cover changes at the study area which can help decision makers to replan the use of natural resources efficiently. If budget is a constraint in purchasing high resolution satellite imagery, then one could consider utilizing free Google earth images as proposed study. Land use land cover changes is considered one of the most important signal of regional environmental changes. Smart city projects are important for urban policies in as much as they allow for a reinvention of territories, smart city is a good programme because it can aim at developing a new form of modernity and civilization of productive platform. Arc GIS is used to distinguished the land pattern. Smart is nothing but digitalization. ARC-GIS is used for representation of data on map at different scale. Total area is spilt into agricultural, residential, water bodies, open land etc. There is observable change in land use land cover map of study area occurred in last decade.**

Keyword – Land use land cover map, Satellite imagery, Land utilization, ARC-GIS.

I. INTRODUCTION

The term smart city was inserted into the communitarian official document in 2009. The concept was introduced for first time in 'Strategic Energy Technology Plan' (SET), there it defines a smart city as a 'city that makes a conscious effort to innovatively employ information and communication technologies(ICP) to support a more inclusive, diverse and sustainable urban environment. At first it was thought that smart city would be like a digital city. The concept of smart land is an extension of smart city, it is connected to sustainability and green economy.

After independence the population of our country increases day by day, due to that problems like shortage of basic amenities, shortage of land and increase in population rate are occurred. Due to increase in population price of land are increases day by day, to overcome such problems smart utilization of land is necessary. Land is the very important component of the life support system and which embodies most important natural resource that is soil and water. Land is finite resource and its availability is only 20% of earth surface which is crucial for all developmental activities.

In recent decades use of satellite data has replaced the traditional field survey method in preparing urban land use land cover map due to advancement in GIS (Geographic Information System). Land use and land cover terms are often used together. Developing a smart city requires many types of information including geospatial information. By applying remote sensing / GIS techniques, area of rapid developments is identified and targeted for more detailed monitoring of the field.

II. LITERATURE REVIEW

A review of important studies which utilized Google earth images in classification for urban related applications was attempted and presented in this section. The authors mentioned that use of due to the high cost of very high resolution satellite images such as Worldview_2 having a spatial resolution of 0.46m with eight spectral bands, it is not possible purchase and use it even though it has wide variety of applications in the field of urban planning. In all the studies reviewed it was found that the authors have used images from sensors such as Landsat, LISS-3 to prepare landuse map of different year for urban applications. For most of studies it was downloaded from global land cover facility(GLFC), GLFC provides satellite data at free of cost but it has certain limitations. Images provide by GLFC are of medium resolutions only with pixel size ranging 30 to 80m therefore it is not possible to see each and every thing clearly. (K. Malarvizhi, S.Vasantha Kumar and P. Porchelvan, 2015: ICETEST).

The land availability of land within the city are fixed and cannot be limited meet the needs of the population. High utilization of land for residential areas along with increasingly high rates of population growth either naturally or migration. (Diah Intan Kusumo Dewi, Anita Ratnasari R, Pangi, 2016: Cities 2015 International Conference). The present study tries to create an alternate solution for all the above said problems by using free Google earth images to prepare landuse landcover map. In this google earth images one can clearly see roads, residential area, agricultural area, water bodies, open land, forest etc. clearly and it can be digitalizing by using ARC-GIS. (Mohammed Esmail, Ali Masria, Abdelazim Negm, 2016: HIC). Google earth images provides latest satellite images having spatial resolution less than 1m and also it provides images taken at different time periods.

Nowadays there are various popular software's for image processing and GIS software's like ARC- GIS, Global

Mapper, ERDAS, IMAGINE, ENVI etc. That software's have provided tools to visualize and import google earth images. (Qing chang, Xue Li, Xiulan Huang, Jiansheng Wu, 2011: ICESE).

Though there are more advantages of using Google earth images but there are very limited studies have performed on the use of this excellent data source for preparation of land use land cover map (Ohri and Poonam,2012: Jacobson et al.,2015).

There is one limitation of using Google earth image that it is not possible to obtain multispectral band data and therefore image classification by using unsupervised or supervised techniques cannot be carried out. Due to high resolution on-screen digitalization in ARC-GIS can be easily done.

III. OBJECTIVE

The aim of the study is to develop or prepare land use- land cover map which can be used for urban related applications using RS and GIS platform. In the present study, an attempt is made is made to show this excellent source of information can be used for the development of smart city.

Objective of the study,

1. To study the present land development.

2. To develop an updated land use data for the study area.

3. To perform land use change study using RS and GIS technology.

4. Identify and remark the areas of rapid development.

IV. METHODOLOGY

Firstly, the base map for the Pune corporation area was collected from Pune municipal corporation then it was scanned and georeferenced by giving latitude and longitude values using ARC-GIS 9.3 software. Geographic information system(GIS) is the any manual or computer based set of procedures used to store and manipulate geographically referenced data. (Arnoff, 1989). The base map of Pune corporation area was georeferenced by using toposheets. The boundary of Pune municipal corporation area is digitalized and has been converted from ARC-GIS shape file format (.shp) to Google earth compatible format (. kml). According to that base map of Pune municipal corporation area the Google earth images of different time periods (2008, 2010, 2012, 2014, 2016) were downloaded and then that images were cropped in Global Mapper 15.2. by using base map of Pune municipal corporation area and saved that images year wise.

Then Google earth images are exported to ARC-GIS for the digitalization and drawing. Digitalization is the method of translating a map into a digital form. A map conveys geographic relationships and present analysis results. For digitalization various shape files were created. Shapefiles can only contain one feature class. Shapefiles are a vector file structure for storing vector file structure for storing the

location and attribute information of points, lines, polylines, polygon. Each shapefile consist of at least three files: <name>.shp, <name>.shx and <name>.dbf. Artcatlog is used to copy, move, or rename shapefiles. While digitalizing land use classes considered are residential area, agricultural area, open land, roads, forest, water bodies etc. by creating shapefiles. The important advantage of Google earth images is that it provides images taken at different time periods which can be used by urban developers for change detection in land use and land cover and to prepare updated land use land cover of study area

V. DATA COLLECTION

A. Pune municipal Corporation Area.

Pune corporation area is taken as a study area. Figure no. 1 shows the base map for the study area and figure no. 2 shows the recent Google earth image for the study area. Pune is the 9th most populous city of India and 2nd largest city in the state of Maharashtra after state capital Mumbai and is also 101th most populous city in the world. It is situated 560m above sea level on Deccan plateau. On right bank of the mutha river. Pune city is the administrative head quarter of Pune district and was once the centre of power of Maratha Empire established by Shivaji Maharaj. Pune is the cultural capital of Maharashtra.
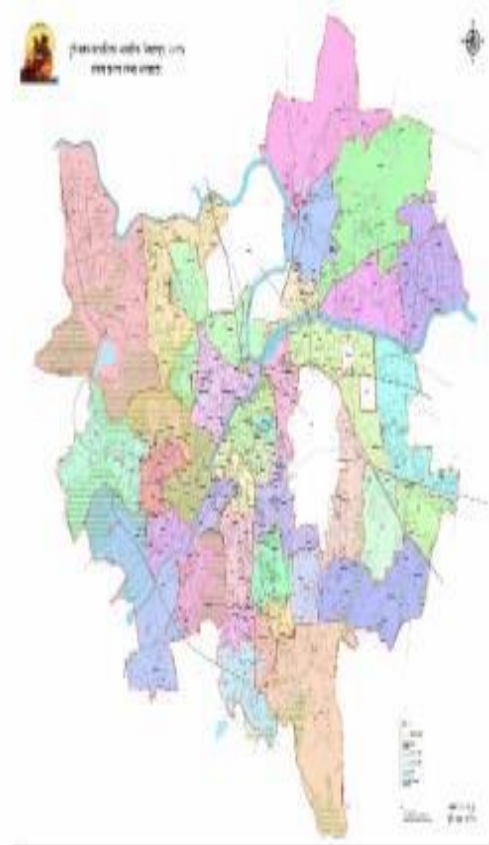

Fig. 1. Map showing Pune corporation area.
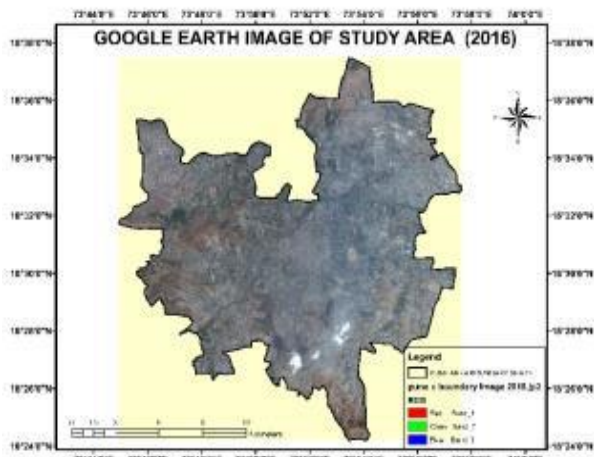
(SOURCE- WWW.PUNECORPORATION.ORG.)

FIG. 2. GOOGLE EARTH IMAGE OF STUDY AREA (2016)

For the metropolitan city like Pune, urbanization is a major concern. More people are migrating from rural area to urban area like Pune city for better job, opportunities and living conditions in recent decades due to economic growth in country. In the developing country like India urbanization is unavoidable, however if it is not controlled properly may result in loss of productive agricultural land, deforestation, crowded habitats, water distribution and sewage treatment problems, air and noise pollution, traffic congestion etc. It is essential for urban planner to see at the current land use pattern before they start planning for smart city.

VI. RESULTS AND DISCUSSIONS

The present study aims to prepare the land use land cover map using Google earth image for Pune municipal corporation area. The updated (2016) landuse and landcover map of Pune municipal corporation area is prepared by utilizing Google earth image is shown in figure 4 and figure no. 3 indicates the landuse and landcover map of Pune corporation area for year 2008.
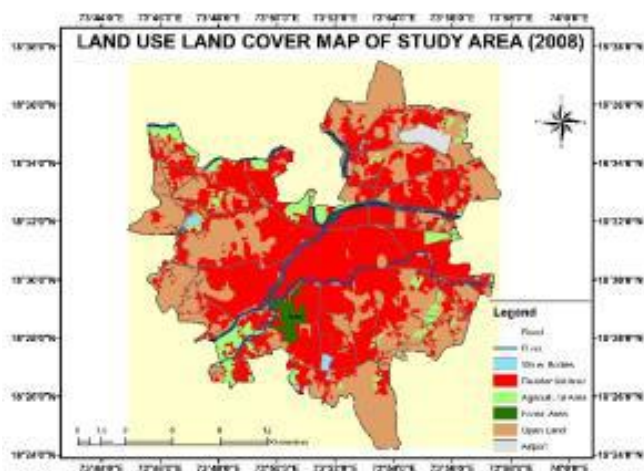

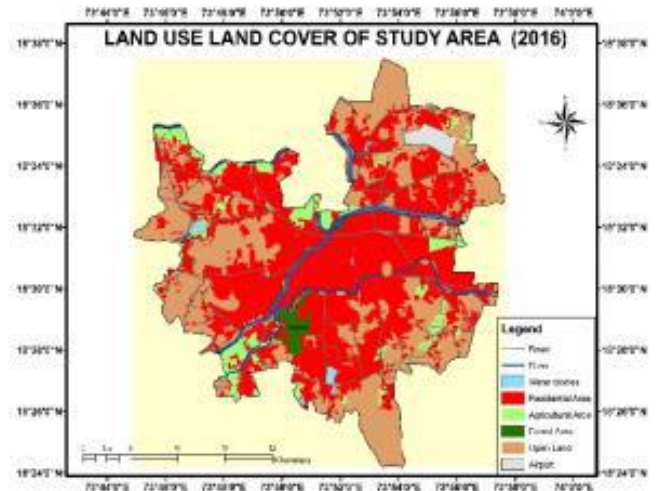Fig. No. 3. Land use land cover map of study area (2008).

Fig. No. 4. Land use land cover map of study area (2016).

It was found that the area occupied each classes that is residential, agricultural, open land, roads, water bodies etc. in land use land cover map of 2008 and in land use land cover map of 2016 are changes. This change detection in the land use pattern is observable. This urban change detection is due to the urbanization and migration of peoples from rural area to urban area. It was found that the area occupied each classes that is residential, agricultural, open land, roads, water bodies etc. in land use land cover map of 2008 and in land use land cover map of 2016 are changes. This change detection in the land use pattern is observable. This urban change detection is due to the urbanization and migration of peoples from rural area to urban area.

Above maps shows the various areas with different colors falls under residential area, agricultural area, open land, roads, forest, water bodies etc. changes among the various land use land cover classes are assessed. Digital change detection is the process of describing changes in land use pattern. The result shows that the residential area is increased.

VII. CONCLUSION

In the recent decades, most of the cities like Pune are facing the urbanization because peoples are migrating from rural area to urban area for better job, opportunities and living conditions in recent decades due to economic growth in country, and this migration of people from rural area to urban area is unavoidable urban developer understand the current land use land cover pattern of that area and then urban developer should able to know how land use land cover of that area changes over the years.

For preparation of land use land cover map of the area purchasing of latest high resolution satellite images is very expensive and to overcome this problem Google earth images can be utilized which are free of cost and gives clear views of area. If cost of purchasing land satellite image is a major constraint, then use of free Google earth images for the study

and preparation land use land cover map and find out change detection is possible.

In present study, Pune municipal corporation area is taken as a study area. By using ARC- GIS software On screen digitalizing is done. The area of various land use classes is digitalized and land use land cover map is prepared by utilizing Google earth images of year 2008 and 2016. After observing land use land cover map of 2008 and 2016 there is a observable change detection in land use pattern.

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