A Project on

Geo enabled functioning and Administration in Urban Local Bodies. A case of Property Tax Collection.

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CS671: ICT in Socio-Economic Development

by

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Contents

1. Introduction

1. About 73-74 constitutional amendment act. How has it changed the scenario for urban local bodies?

The struggle of local authorities to keep up with rapid changes in Urban atmosphere started as when 73-74 constitutional Amendment Act was passed which elevated the status of municipality from being state dependent to become self-government. Self-government is the government ruled politically by inhabitants without any interference by outside authority. Funds which were previously taken care of by State governments and central governments as grants and aid now came completely over the shoulders of city administration.

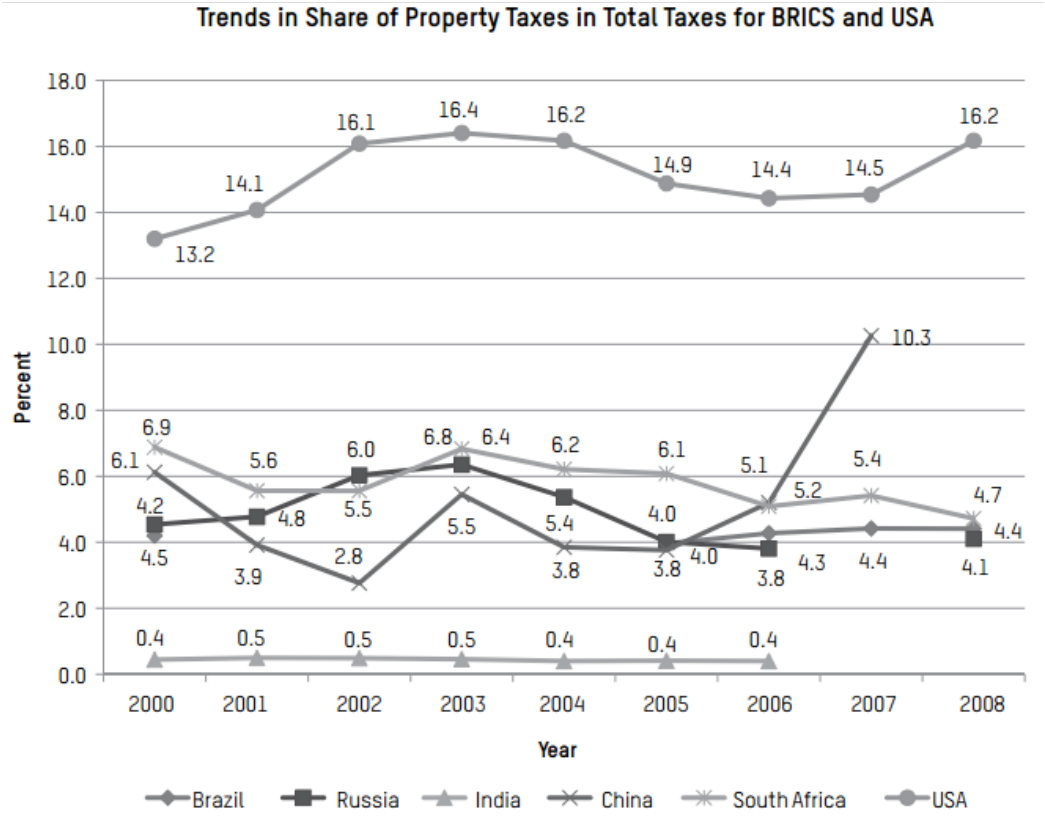
2. How the need of funds has kept urban areas deprived of the development and inclusion of latest technology to manage urban areas.

Due to this amendment in constitution city was able to propose and adopt new methods and technologies to provide its citizens with good quality of life. But the need of revenue generation was not thought and framed properly.
The revenue for the city is generated from levies, octroi, taxes etc. To upkeep with the growth of urban population by providing utilities and services, authority must collect fair amount of its share from the citizens as taxes. The majority of the revenue generation is collected from property taxes, but it is far from being sufficient. According to statistics, some major cities like Lucknow and Kanpur have more than 50 percent share of property taxes as total revenue generation.

2. Problem definition

1. Property Tax collection as a problem.

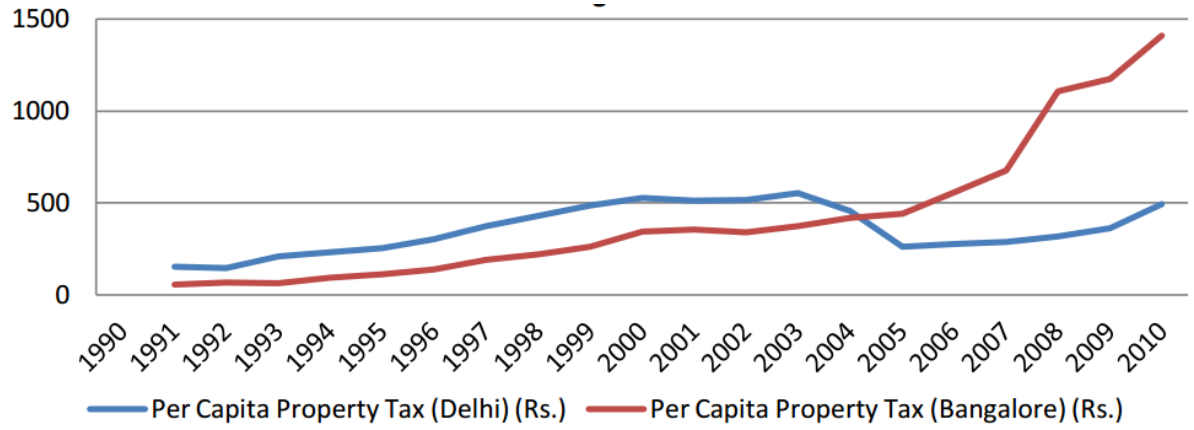
Economic Survey of India 2016-17 made an attempt to assess property tax potential of Bengaluru and Jaipur using the latest satellite-based imagery. The results estimate that currently Bengaluru and Jaipur are collecting no more than 5 to 20 per cent of the property tax potential. Collectively, Indian cities as a whole only provide 0.4% of the total taxes being collected in the country which is much higher in other Developing and developed countries.



Source: Oxfam working Paper on Property Taxes across G20 countries

2. Why this problem persists?

Large no. of properties are not being registered with the authority. Some of them being empty plots which are not considered. Studies from 14th Finance Commission on Municipal finances have shown that per capita property tax collection is Rs 1677 at the most and 42 at the lowest.



Per Capita Property Tax Collections at Current Prices of Delhi and Bengaluru.
Source: Property Taxation in Indian Cities: A Comparison of Delhi and Bangalore, Simanti Bandyopadhyay, ICRIER

In the above graph it can be clearly seen that although the no. of properties increased in Delhi but the amount of tax collection from properties was never increased. The behaviour of Delhi in graph after 2003 was due to introduction of current Property Tax collection formula which demanded reassessment of properties to calculate Covered Area(will be discussed in later sections).

Local bodies do not have developed framework to judge property-tax based on defined parameters to obtain the correct amount of tax. Low coverage, low rates, low collection efficiency are rampant due to low manual surveyors employed by authority. Apart from these other issues are :

- Low rate of tax filing, high arrears
- Wrongly assessed properties.
- Delay in preparing the list of defaulters
- Property records maintained in papers
- Tampering of records
- Inaccurate and inconsistent data
- The case of illegal properties or colonies which are build without following norms but now have come under the boundaries of municipality.

3. What steps have been taken to counter that?

Many urban local bodies such as Bengaluru and Hyderabad have been taking technological measures to cope with the unassessed properties using GIS techniques. Creating an accurate database of properties present in the city is most difficult work as most of the cities still use paper based records which are not feasible today. Due to the current investment into cities as smart india initiative, the cities are gearing up to attract potential investors and companies. Due to which elevating finances from revenues is their first priority.

4. How tax is calculated?

Urban ecosystem is very complex, no one formula can properly estimate the tax which a property owes to the local government. Every approach to collect taxes has its own shortcomings. The major problem for authorities is to verify and conduct manual inspection of properties. The parameters on which the taxes are collected such as land use, plot area etc should be easy enough to be applied in field and complex enough to cover all the aspects of the built structure. There are two examples of collection strategies (formulas) which are being used by authorities in Delhi and Bengaluru.

- Delhi property tax collection:

  Annual Value = Covered Area x Base Unit Area Value x Multiplicative Factors (Occupancy Factor, Age Factor, Structure Factor, Use Factor)

a) Covered Area: The floor area covered including the thickness of the walls and the verandahs, chajjas, lobbies etc.
b) Base Unit Area value: different categories of properties A, B, C, D, E, F, G, H at Rs 630, 500, 400, 320, 270, 230, 200, 100 per sq. m of area respectively.
c) Structure Factor (SF) : 1 for pucca and semi pucca , 0.5 for kutcha categories.
d) Age Factor (AF): Before 1960 = 0.5; 1960 -1969 = 0.6; 1970 - 1979 = 0.7; 1980 - 1989 = 0.8; 1990 - 1999 = 0.9; After 2000 = 1.
e) The Occupancy Factor (OF): Residential “self occupied unit” = 1; Residential “rented” unit = 2.
f) The Use Factor (UF): Five category classification of non residential properties: Public Purpose = 1 ; Public Utility = 2; Industry, Recreation, Clubs = 3; Business, Restaurants, Hotels up to two star = 4 ; Hotels, Towers, Hoardings with 3 star ratings and above 10.

The collection formula for city like Delhi is overly complex to be used for small and medium cities. The major problem is in calculation of covered area and occupancy factor. As there has been no existing database which provides information on present built structures, Manually surveying the property to create an estimate of this value is difficult. Moreover, the Land Uses with the mixed character have not being considered.

- Bengaluru property tax collection:

  For assessment of Residential Properties

  1. MUAV x 10 months = T1
  2. T1 - Applicable Depreciation = T2 (Taxable Annual Value)
  3. T2 x 20 per cent = T3 (Property tax)
  4. T3 x 24 per cent = T4 (Cess)
  5. T3 + T4 = T5 (Gross Property Tax payable)
  6. T5 x 5per cent = T6 (Rebate for early payment).
  7. T5-T6= Net property tax payable

  For assessment of Non-Residential Properties

  1. MUAV x 10 months = T1
  2. T1 – applicable depreciation = T2 (TAV)
  3. T2 x 25 per cent(Tax) =T3
  4. T3x 24 per cent (cess)= T4
  5. T3+T4=tax payable

a) *MUAV (Monthly Unit Area Value) = Built up area x Unit Area Value.*
b) Unit Area Value was fixed as per the zone, in which the property is located plus certain characteristics of the building such as roof and floor type.
c) Built up Area is the total area covered by the built structure including floors.
d) Taxable Annual Value (T2) is the value applied after deducting depreciation of the property value considering its age.
e) Property Tax (T3) is just the 20 percent of the Taxable Annual Value.
f) Cess (T4) is the fraction (24%) of the Total property tax.
g) Gross Property Tax Payable (T5) is the total amount which is to be paid.
h) Rebate for early payment (T6) is also applied (5%) if due tax payment is done early .
i) Net property Tax payable is the remaining amount after Rebate.

The tax calculation has been made simple and efficient by authorities though problem may arise due to calculation of Unit Area value which also has characteristics like floor and roof type and its area. It is also citizen friendly as the option of rebate is also provided if payment is done early. But it does not cover the variety of Land Uses and its evolving nature and cases where vacant plots are present.

3. Requirements- Data / Hardware / Software

The requirements to solve this problem is manifold. We have focused on the development of portal for assessment of tax collection by the administrators. This portal would help in providing insight into the collection statistics periodically. The portal would provide plotted map, where each of the plot will consist of all the required information to calculate tax such as land use, building age, ward no., F.A.R etc. It also provides the overall combined statistics about total amount collected, ward-wise collection etc. The portal is made in HTML with javascript libraries so there were no software requirements as such.

4. Real world issues and considerations / assumptions

1. Issues in collection of property taxes.

The collection of taxes using the static formulas as in case of especially Delhi does not provide enough flexibility to local body to efficiently survey the whole property and produce the amount of money needs to be collected. The major problem arises as the city grows, the landuse starts changing overtime, Residential slowly become mixed due to opening of retail shops in mostly ground floor of the property. Residential unit is sometimes also used as Banks, ATM’s, offices, tuition centres, cyber cafes, parlours etc. These new additions to the property often go unnoticed by the authorities.

2. How to maintain the tax amount reasonable according to the services provided.

Apart from being one of the major source of revenue for the government, Property tax also plays important role in municipal elections, where the contestants promise to keep the taxes steady so as to woo voters. This problem is prevalent almost everywhere and very little can be done seeking this behaviour of candidates.

In this project we have tried to come up with solution to create a framework which focuses on considering variables which are easy to survey by municipality and further easy to calculate. As our framework focuses in application in comparatively newer cities, where growth has just started. Larger cities, such as Delhi, Mumbai, Bengaluru on the other hand are complex to administer. Proper attention hasn't been given to these cities while in past years in property tax surveying and collection. Therefore it has grown more difficult over the years to prepare framework considering all the constraints and variables.
On the other hand cities which have started growing just recently are still in need to adopt the tax collection framework such that it still prove efficient at the later years.

5. System design and working- Functionality: Inputs, outputs and constraints

1. Portal functionality, its inputs and outputs.

- Modified Property Tax Collection Formula (Also see the table below)

*Total value : (Land Use Value * Structural Value) + (Base unit area * F.A.R Value) + Development Tax + Additional Cess + Additional Fees*

a) Land Use Value : It is the predefined value which is associated with every Landuse in which a structure is built.
   i) Land Use Value = (Value of Land Use * (Area of Plot / 60 sq. m))
   ii) Land Use value takes care of the plots which are built on different land uses, hence are required to pay more tax accordingly.
   iii) The Special case is also considered for Properties which have mixed land use, The two main categories being considered are Residential + commercial and Commercial + Residential.
   iv) In the above case, calculation of Land Use value needs to be calculated as per the ratio of the area covered by built-up of both land uses with respect to total plot area.
   v) For e.g. A plot of 100 sq. m having 200 sq.m of Residential built up and 50 sq.m of Commercial will share the Plot area of 80 sq. m for residential and 20 sq. m for commercial.

b) Structure Value: It is the factor which is multiplied to Land use value, It is based on the Age of the property. The Age of property determines the Operational and Maintenance costs of the building. Moreover, Once a building is constructed, Its value starts depreciating. It is contrary to the empty plot, whose value keeps on increasing.
c) Base Unit Area : Its Value is fixed by authority for per sq. m of super Built up area. This Super Built up area is the total Area allowed by the Authority to build. The Value of Base Unit Area may be different for different locations in the same city.
d) F.A.R Value : It is the factor which is multiplied with Base Unit Area according to F.A.R consumed by the property.
    i) If a particular property was built less than given Built up, A factor of less than 1 is multiplied, while if property overshoots the limit, it is penalised by multiplying by a factor of 1.5.
    ii) For e.g. For e.g. A property is allowed to build up to 250 sq. m but is built on 125 sq.m, The *(Base unit area * F.A.R Value)* would be *The Base Unit Area amount for 250 sq. m X 0.7.*
e) Development Tax : Urban Local body sometimes develops some area or the neighborhood in the city. These developments are sometimes small but critical like maintenance of Public Grounds, Waste Collection etc. This tax is added to the property which are directly benefitted with these developments. It can vary from area to area in same city.
f) Additional Cess : There are examples of cities which collect fees for provision of utilities such as provision of water supply lines, Gas connection, telecommunication or Electricity. This fees is often added to the total tax for efficient collection and low manpower usage.
g) Additional Fees : This is the remaining dues or fines which a property has to pay along with the overall taxes.

VARIABLES			VALUE TO BE ATTACHED (per 60 sq. m)	
AREA OF PLOT				
LANDUSE	R-1	RESIDENTIAL	1000	
	R-3	RESIDENTIAL + INFORMAL	200	
	C-1	COMMERCIAL RETAIL	2000	
	C-2	GENERAL BUSINESS AND DISTRICTS/CENTRES	3000	
	C-3	WHOLESALE, GODOWNS, REGULATED MARKETS	5000	
	C-4	SERVICE SECTOR	5000	
	C-5	REGULATED INFORMAL/WEEKLY MARKETS	1500	
	C-6	BANKS	7500	
	IND	INDUSTRIAL	10000	
	M-1	MIXED RESIDENTIAL+COMMERCIAL	%age area dedicated to Residential and commercial	Total built up will be assessed as residential area + commercial area
	M-2	COMMERCIAL+RESIDENTIAL	%age area dedicated to Residential and commercial	Total built up will be assessed as commercial area + residential area

		DEPRECIATION/APPRECIATION VALUE
STRUCTURAL VALUE	> 60 YEARS	0.6
(Age of Property)	< 60 YEARS	0.7
	< 45 YEARS	0.8
	< 30 YEARS	0.9
	< 15 YEARS	1
	VACANT PLOT	1.5
DEVELOPMENT TAX	DIRECT TAX	VARIES
(According to location of the plot)		
		VALUE TO BE MULTIPLIED TO BASE PRICE
FLOOR AREA RATIO	> 100%	1.5
(Percent Achieved from given F.A.R to Original Built F.A.R)	eq to 100 %	1
	75 - 100 %	0.9
	50 - 75 %	0.8
	25 - 50 %	0.7
	1 - 25 %	0.6

BASE UNIT AREA VALUE		VARIES
(Fixed Base Price of tax)		
ADDITIONAL CESS (IF ANY)		VARIES
(Previous Balance amount)		
ADDITIONAL FEES (IF ANY)		VARIES
(Electricity fees or water charges)		
TOTAL TAX		

Functionality: The portal is HTML page with javascript libraries such as leaflet and d3 are used. Leaflet is a open source javascript library for interactive maps, it is lightweight and therefore perfect for our project. It helps to display maps in the browser keeping zoom, Lat-long information intact with respect to map in question. D3 is also open source javascript library which is used to manipulate documents based on data. It helps provide data representation and visualization in the form of charts, histograms, plots etc. Other libraries such as bootstrap and jquery are also used to provide additional fluidity in event handling and responsiveness in operating the portal.

Inputs: The portal takes shapefile(*.shp) (A data format for GIS documents) rendered as JSON(javascript Object Notation) where all the required information regarding every plot is fed as a table. For demonstration purposes, we have taken shapefile of Vapi city, which is also the Industrial hub of Gujarat.
The heads of the table include

- Permanent ID number, Name
- Landuse, Age of the Building
- Area of the plot, Ward no.
- Total Built up area,F.A.R allowed
- Base Unit Area , Development tax
- Additional Cess, Additional Fees

This shapefile contains data for one year. For the subsequent years, other similar shapefiles are fed into the portal which have same heads but with varying values. These shapefiles along with the original one helps in comparison of the same property on different parameters such as increase or decrease in tax collection over time, increment in build area, addition of commercial land use to the same plot etc.

Outputs: The portal thus calculates the total property tax for each plot according to tax calculation formula and display all the relevant statistics such as Permanent no. id (PID) of the plot, collected tax, F.A.R stats as charts and graphs on the dashboard. The representation of the data is done into two parts, one : plotwise, where every statistics is provided plotwise, so every small detail about the plot can be seen in the dashboard. In another part, the representation of statistics is collective. It provides the combined representation of total tax collected as a ward or as per land uses. It helps in quickly able to give relevant information on collection scenario without dealing with the small ground details.
Constraints: The portal expects the information regarding the plots which may only be possible by ground surveying and truthing. A manual door to door surveying would be necessary by municipal inspectors. The data thus collected will then be required to be correlated to the actual plots in GIS database. After this process, the data thus generated can be fed to the portal.

This portal is not made in view to be used by public, it's more of an official kind of dashboard. The data collected from the field will be fed in the portal and the statistics will be generated, all the comparisons and other functionality may be exercised along with the previously fed temporal data.

6. Test results

Image of Portal (Image 1) here displays Vapi City, which has majority of landuse as Industrial. This image shows the satellite imagery in background which is visible underneath the plot on mouse overlay. It shows the present assigned landuse of the city with required information about the selected plot in the left panel. The portal also displays the plot from which the tax yet to be collected (Image 2) and the phase wise collection statistics (Image 3).

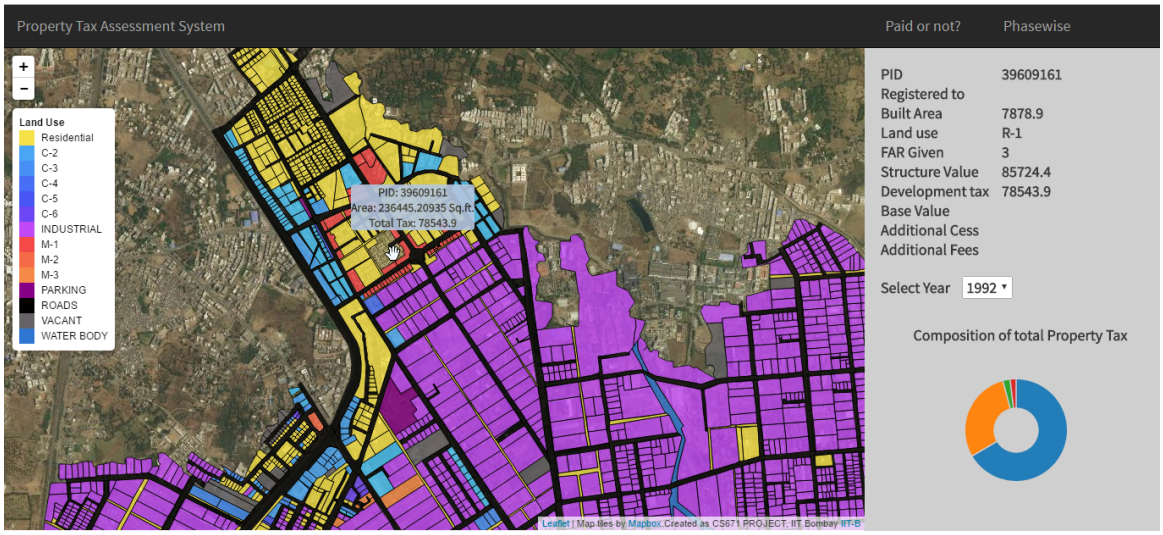


Image 1: Portal displaying Landuse and plot information

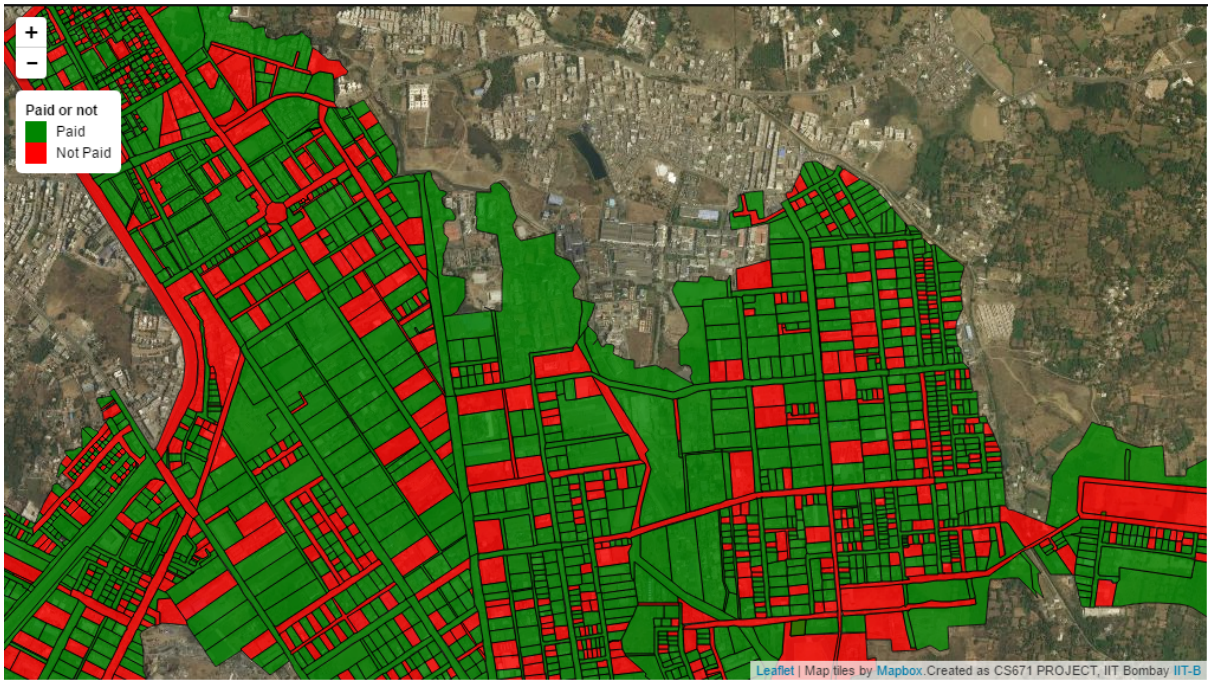


Image 2: Portal displaying the tax defaulters.

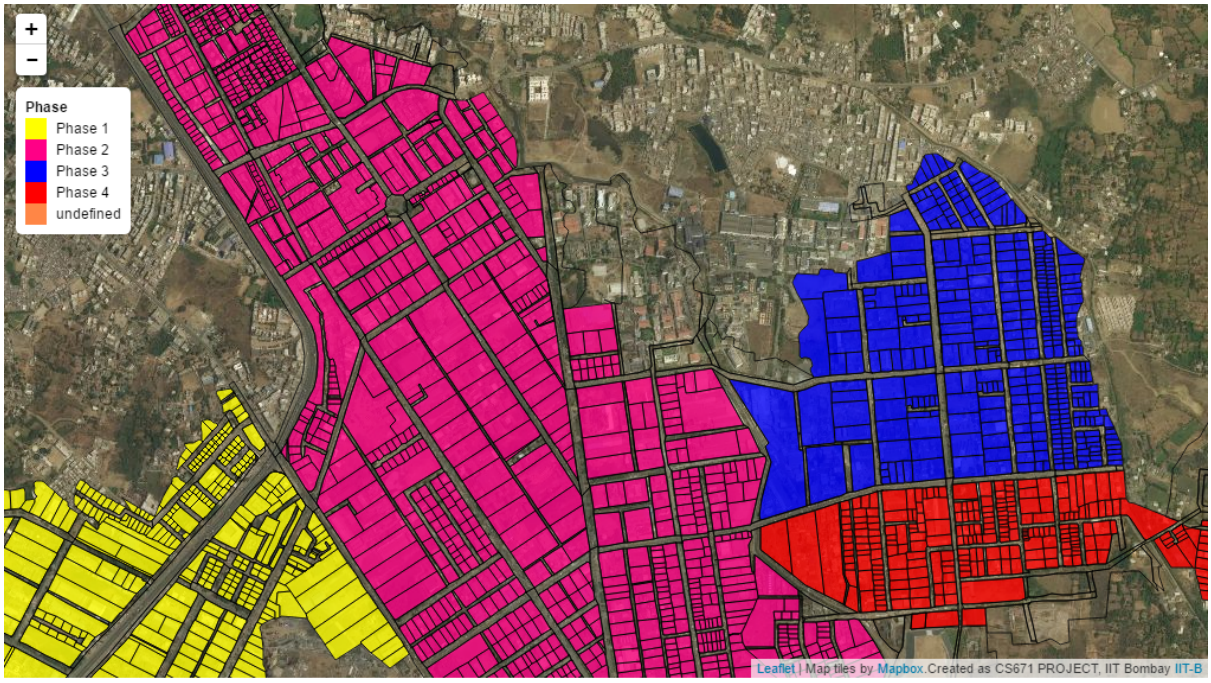


Image 3: Portal displaying Phase wise plot distribution in city

7. Conclusions

Our goal was to assess the state of property tax collection and try to provide solutions on improvements which can be made possible within short span of time and with open source solutions.

In this project, One of the urban solution regarding digital assessment of property taxes is attempted. This process can be taken by the small to medium size cities which are in the need to shift from paper based records or the static digital System to more dynamic and collective system based on latest software frameworks.

In Urban Planning, no project is successful until it gets implemented, other project is no exception. But it provides and takes care of all necessary elements one might need to consider to come up with an efficient Property tax collection system. There are various assumptions which have been made to demonstrate the working of this project. Data regarding all or some of them might be difficult to gather. The Urban problem like these have multifaceted character and are driven by various variables and elements, All of which cannot be studied.

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