Web-based GIS application at Surat Municipal Corporation

Design, Development and Implementation of Web-Based GIS Application Along With GIS Database at Surat Municipal Corporation

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Background

Surat city, termed as economic capital of Gujarat, is globally renowned for its diamond cutting and polishing industry. The city is also well known for producing 40% of nation's total man-made fabric and 28% of nation's total man-made fibre. Surat Municipality was established in 1852 and was made a Municipal Corporation in 1966.

Surat has witnessed unprecedented growth in last four decades and with the expansion of city limits in 2006, city area increased to three times.

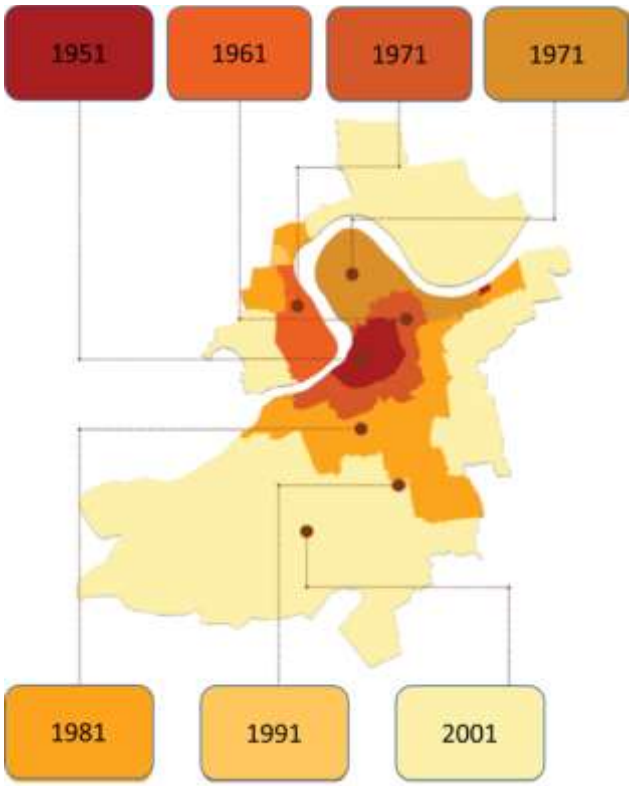

Figure 1: Geographical expansion of Surat

With Gujarat's Town Planning scheme being successfully implemented in Surat, there was a need felt for integrating all the spatial data for efficient and transparent administration. A Geographical Informatics System (GIS) was launched in 2015 after over three years of surveying and software development, among other processes.

Why GIS?

All records related to Town Planning Schemes and the plot numbers were stored physically. The utility network drawings and details were kept manually in the department, and people interested in real estate had to come to the municipal corporation for search of the sanctioned details of the building. There was no particular geo-referenced base map of the Surat city before the initiative. Budget proposals were monitored on the data available and not spatially. Thus, for more transparency and accountability led to the conceptualisation of the GIS initiative.

The GIS initiative is going to make the corporation monitor and supervise the projects spatially and non-spatially. Almost all the information related to the municipal governance has been transferred to the public domain. This led to full transparency and accountability over and above efficient monitoring of the projects.

Project details

The project has been executed by the Town Planning Department of the Surat Municipal Corporation (SMC) and is supported by the Information Systems Department.

SMC awarded this project to Antrix Corporation, Government of India and its partner Scanpoint Geomatics Ltd. (SGL). Antrix was the technical partner whereas Scanpoint Geomatics Ltd. is the implementing and maintenance agency. It has developed IGiS (Integrated GIS and Image Processing Software), jointly with Indian Space Research Organization (ISRO), Govt. of India over a period of several years.

SMC GIS web application was developed by Scanpoint Geomatics Ltd. and that has integrated more than 100 layers for use by Town Planning Department, Property Tax Department, Road & Transport, Hydraulic Department among others utility departments. Broadly, the following process was followed:

Preparation of Geo-corrected Base Map: This entailed the following processes

- Collection of ground-control points (GCP) and high resolution satellite images;
- Image processing;
- Geo-referencing;
- Superimposing Administrative boundaries, TP maps, DP maps and utility layers on Satellite image and Road extraction;
- Incorporation of existing departmental maps;
- Property extraction from Satellite Image (On-screen digitization).

Base map was prepared for SMC area (326.51 sq. km) using high-resolution imageries (Quick Bird – Resolution 0.6m) in 1:500 scales. Two satellite images, bought from National Remote Sensing Centre (NRSC), of years 2006 and 2012 are being used as the base for the Surat GIS web application. One satellite image costs about Rs.15 lakh and size of the file is approximately 10GB. This was integrated into GIS platform using geo-referencing points, and overlaid with administrative boundaries. North zone was the pilot for TP scheme integration.

Data Collection (Primary & Secondary): Dedicated teams worked for the department data collection, field survey, total station survey and property field verification. Thereafter, property details were integrated with GIS database.

Building approval system and property tax database were pre-existing SMC systems that were integrated with the GIS application. SMC had already taken the building approval system online but Scanpoint integrated it with GIS. Property tax database was available on SQL server and this too was integrated with GIS application after field verification. For integrating property tax information, physical survey was done for 15 lakh properties and it was verified using random samples by SMC[1]. Thus, two surveys were undertaken by Scanpoint Geomatics Ltd. – a property survey for verification of satellite data and a slum survey for identifying slum boundaries. On the other hand, utilities were mapped on GIS platform by overlaying of physical maps using reference points. Each department of SMC was involved in deciding which all attributes would be added to a module on GIS platform. Following this, ScanPoint added them as a report on the GIS platform.

In sum, the following steps were followed:

[1]SMC reviews one-fourth properties every year by carrying out a field survey. Thus, every 4 years, all properties are updated.

- Step 1: Ground Control Points (2 months).
- Step 2: Slum survey + property survey (6-8 months, subject to exigencies)
- Step 3: digitisation + geo referencing (6-8 months)
- Step 4: coding + testing for GIS data correction and software (1 year)
- Step 5: Testing of the software and hands on training to the employees of SMC

The total project cost for the above mentioned steps was about Rs.3.5 crore. This was budgeted from SMC's revenue itself and the State government was not directly involved in the process.

Scope of Services

The SMC web GIS application mainly has two types of interfaces:

a) Citizen interface which provides limited access rights. Key features of citizen interface are:
   - Plot Search – by Final Plot, Original Plot and Survey Plot
   - Admin Boundary information
   - Form B/F - Owner information and valuation information
   - Part-print - Plot print with required layers and information
   - Building permission
   - Search – Predefine queries

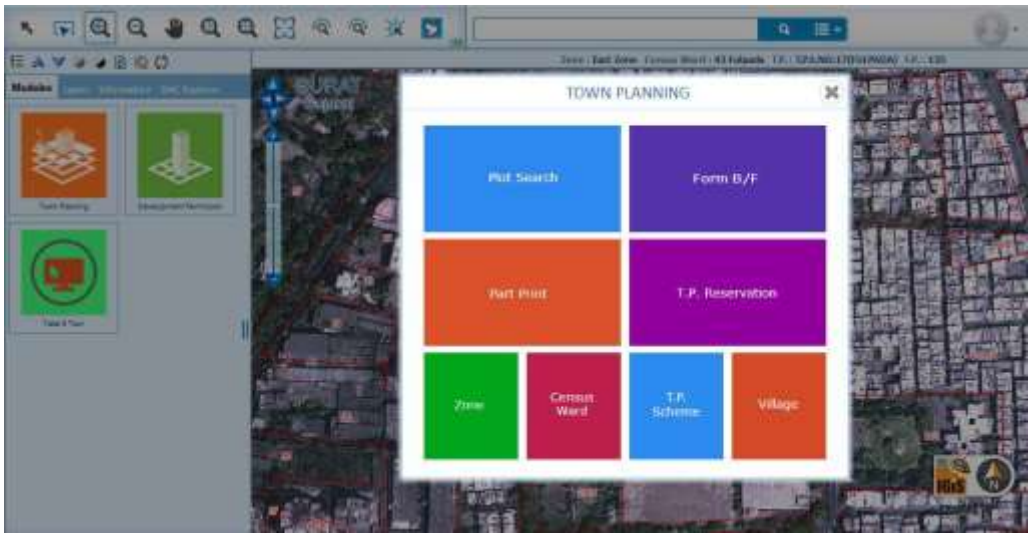

Figure 2: Snapshot of SMC GIS web application – citizen interface

b) SMC departmental interface, which consists various functionalities of different department users of SMC. The following departments are using the web application:
   - Town planning
   - Building permission
   - Property tax
   - Water supply
   - Sewerage
   - Storm water
   - Road and transportation
   - Bridge
   - Slum

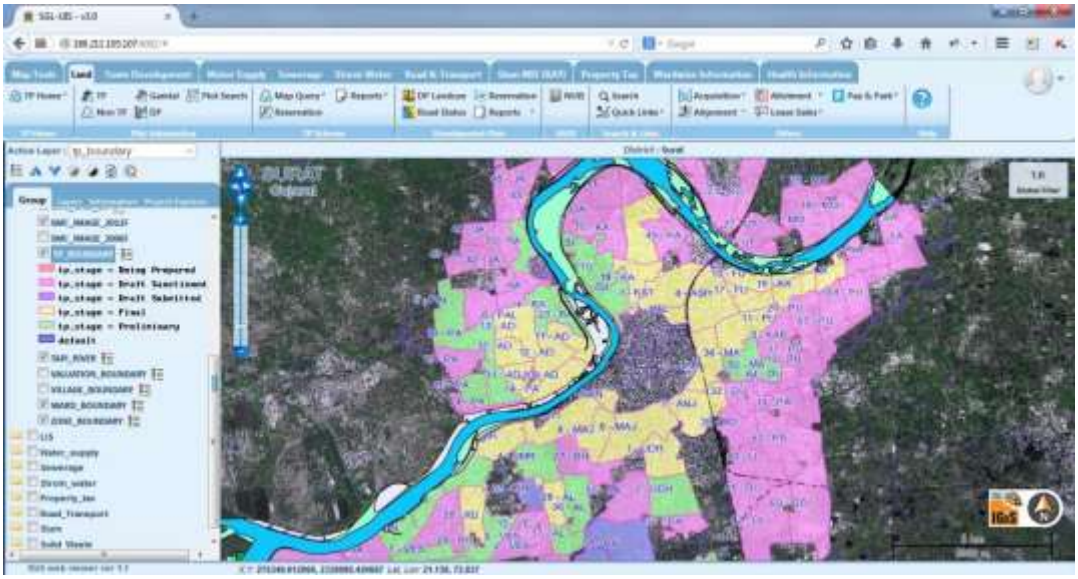

Figure 3: Snapshot of SMC GIS web application – departmental interface

This interface allows for provisioning of the following services, benefitting both the organisation and the citizens:

- Mapping for Utility System like Water Supply, Sewerage System, Storm Water, Drainage System, Road Network and Solid Waste Management System.
- Web based GIS application for planning, management and governance in context of entire functioning of the organization.
- Land Information System (LIS) which carry spatial as well as non-spatial details of Town Planning Schemes, Development Plan, etc.
- Property Tax Mapping (i.e. Linking of Property attributes with Building footprints)
- Integration of Building Permission approval system
- Incorporation of various physical features viz. Road Network, Railway, Water body, etc.
- Integration of existing applications like Property Tax, Shops and establishment, Solid waste management, etc.
- User-friendly Web based GIS application for various departments of SMC.
- Budget proposals (Capital works) (Work in progress) and various permissions like building permission, Building use certificate etc.

SMAC Centre

The GIS web application is monitored at the Integrated Command & Control Centre of SMC, named as Smart City Centre (SMAC Centre). The SMAC Centre was inaugurated on the first anniversary of Smart City Mission on 25.06.2016. The SMAC Center integrates & collaborates data from various departments, Integrated with GIS, this control room can provide critical information like which ward is giving how much property revenue and which areas are malaria hot spots.

Figure 4: SMAC Centre

Benefits to SMC

The GIS web application is being extensively used by the Town Planning Department, Property Tax, and Town Development Department. A total of 17 departments can use it. Recently, there was even an order by the Commissioner to all departments to compulsorily use the GIS application.

- *Centralised database of all departments*: The GIS application has created a central repository of all departments. All the departments of SMC can now easily access the centralized GIS database through web GIS application. It facilitates the inter-department functionality easily because of centralized repository of data and its access. This GIS platform provides support for operational functions and decision making.
- *Efficient planning and decision making*: Master plans can be created with better preparation. About 1.35 million properties are linked spatially in the form of building footprints to the tax data including name of the owner, etc. 128 town planning schemes digitized and integrated into the base map of Surat City. Utility layers and attributes, for instance the position of the sewerage lines and their age, diameter etc., have also been added and this can be used for planning and maintenance. Such information can be used to plan for other projects in a better manner – if there are too many utilities at the junction, then planning department can decide whether a flyover or an underpass or a foot overbridge, requiring digging up for the pillars, is possible or not. However, the latitude-longitude of some of the utility lines is missing and would be undertaking that study soon.
- *Improved property tax collection*: The application has also facilitated improvement in revenue realisation as it allows for geographical representation of tax defaulters. The application is not exactly used for property tax collection but it can be used to assess which areas are not paying the property tax and due to this 'automatically' results can be increased because the visualisation of data can facilitate better assessment and action, as represented in Table 1. Thus, SMC has been able to achieve 100% property assessment.

Table 1: Increase in Property Tax Recovery

Property Tax Recovery		
Zone	2015-16	2016-17
West Zone	50,25,76,986	62,03,99,385
Central Zone	76,59,12,398	94,04,53,854
North Zone	80,72,09,452	100,04,98,160
East Zone	108,35,79,832	125,11,37,270
South Zone	124,26,07,278	148,56,78,196
South West Zone	76,42,43,247	95,40,68,935
South East Zone	79,80,76,367	92,10,91,850
Total	596,42,05,560	717,33,27,650

- *Public Health benefits*: The web application has also been linked to the tracking of malaria cases using tablet based devices. This includes coverage of potential malaria cases, follow-up of positive cases, and identification of water logging/ mosquito breeding sites.

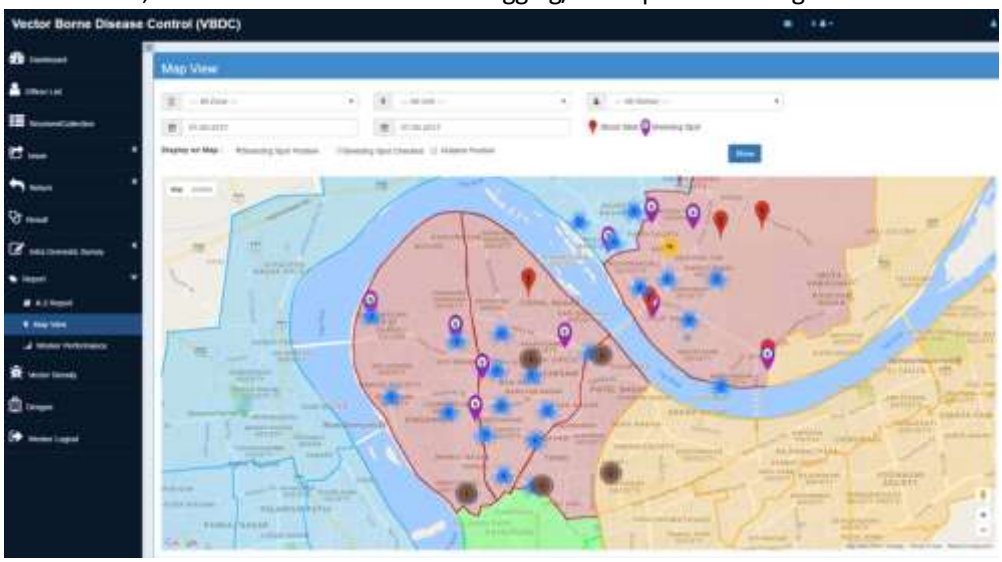

Figure 5: Snapshot of application interface for Vector Borne Disease Control

Benefits to citizens

All the departments of SMC can now easily access the centralized GIS database through web GIS application. It facilitates the citizens to access the local body data like building plan permission details, building use certificate, etc.

- SMC can upload Building Usage Certificate (B.U.C.) on the application. In the last 5 months, the SMC has introduced the feature to approve building layout plans online Citizens can view the details of the building plan approval like name of the builder, type of plan approved, legality of the building, no of dwelling units sanctioned, etc.
- Citizens can print part plans through the application and do not have to visit the SMC offices anymore for this purpose. They can also get authorized plot map information and building permission using internet which saves time and money.

On an average, 120 users login on a daily basis to use Web GIS application in order to get different information like Form-f, part plan, Utility information, Building permission, BUC etc.

Challenges

The entire process of data collection, coordination with different departments and conducting the property survey was not without challenges.

- Data collection from the various departments, specifically the property tax data of 1.35 million household was a magnanimous job.
- The digitization and the linking of the tax data attributes with the building footprints, required special skill and huge manpower for such a large data. The property survey was an extensive process as individual houses had to be verified. SMC had to make multiple iterations to their first methodology of property survey and used a new improved one then. Eventually, the field staff checked tenement certificates for all properties.
- Gujarat's Town Planning scheme was prepared on British Raj maps so it was difficult to overlay the TP map boundaries with the satellite maps and that process took maximum time. The digitised maps were transferred to shape files for the use in GIS and the data as attributes were linked.
- Conversion of hard copy maps to digital form and integrating the large amount of associated data, both for utility networks as well as TP maps was a time-consuming process.
- Coordination of all departments and zones to procure attribute data for different modules was challenging. There was some difficulty for transfer to new platform due to ignorance of the GIS technology and its applicability in office management, but overall the consultants were of the view that SMC staff was quite supportive throughout the process.

Future plans

SMC is in the process of procuring a recent satellite image for the GIS platform and then a new mapping process will be undertaken so that new property and utility developments can be integrated on the application. A mobile app is also in the process of being launched.

SMC is now also trying to correlate Grievance Redressal System with the web GIS application. The current complaint registration and redressal mechanism is in place via a citizen application. Its integration with the GIS network would allow spatial categorisation and analysis of complaints. This would enable visualising which areas are raising most grievances and which type of grievances (for instance, maybe the water pipelines are leaking and that could be because they are old – available as attribute data) and can use that to make a case for property tax payment. The Budget monitoring spatially with the MIS database will soon be operational after integration of all the capital projects under the project monitoring system.

The GIS application is also planned to form a base for the development of an Integrated Transit Management System (ITMS).