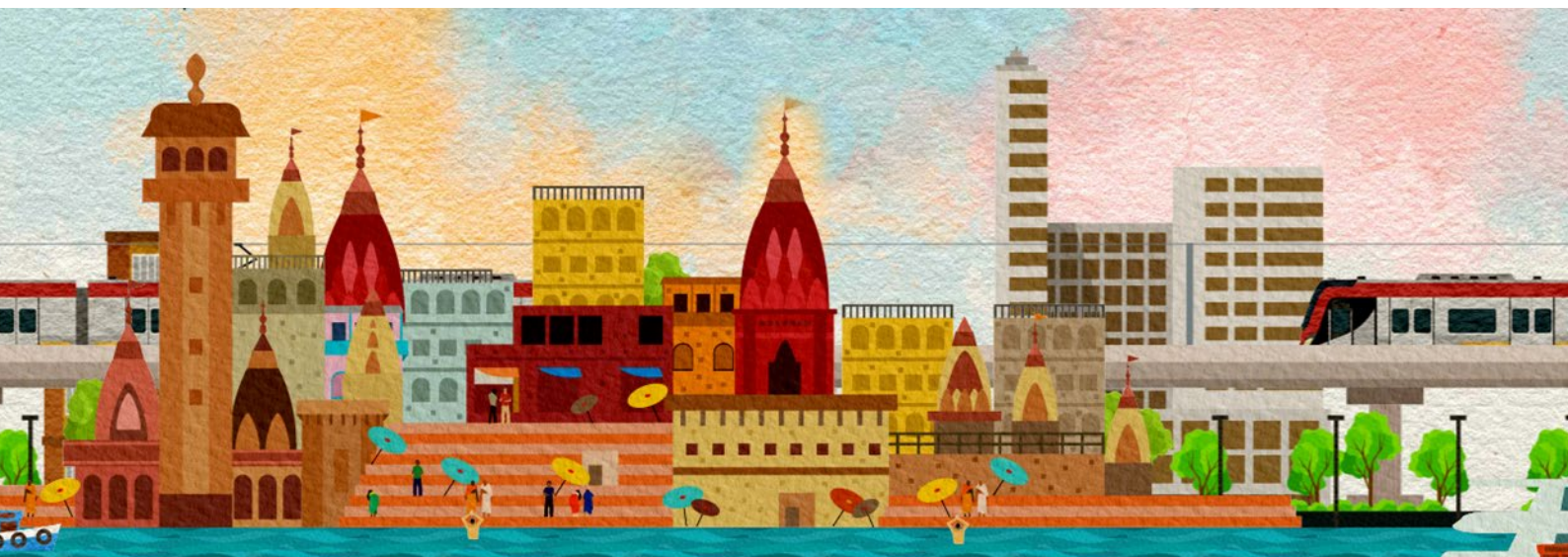


Varanasi Smart City moving towards Real-Time Operations Management using Esri ArcGIS



Twenty-first century cities consume two-thirds of the world's energy, and emit 70% of global greenhouse gases. More than 800 million urban dwellers live in sprawling slums, in health-compromised conditions. Many live in cities that are yet to lose their reputation for being crowded, unsafe, and environmentally irresponsible.

Surprisingly, these inefficiencies have not deterred the demand for urban land. By 2050, two out of three people in the world will live in such cities. In a business-as-usual scenario, they will withstand the worst of climate change, even as they contribute upward of 80% to global GDP.

In the years to come, as their due, urban dwellers will demand intelligent urban planning that creates safe, affordable and resilient cities with green, and culturally inspiring, living conditions. Goal 11 of the UN Sustainable Development Goals has anticipated this demand by calling for sustainable cities and communities. India is attempting to deliver on this commitment through her ambitious Smart Cities Mission. The Mission promotes an area-based development strategy that focuses on city improvement (retrofitting), city renewal (redevelopment) and city extension (greenfield

development). In addition, a pan city initiative will attempt to integrate the city using smart technological solutions.

Identified smart cities will innovate replicable ICT solutions to resolve basic infrastructure issues, enhance the quality of life, and strive for a clean and sustainable environment. The goal is to learn from one another; among the identified 100 Smart Cities, a 20-20 concept pairs up the laggards with the front-runners. Thus, the Mission promotes and innovatively uses smart solutions that all Indian cities can learn from, replicate, and mold to their unique context.

About Varanasi

Among several cities vying for the Smart spotlight, Uttar Pradesh's Varanasi has been making progress in leaps and bounds. The city's success story has important learning points for Indian urbanism. Multiple stakeholders, several layers of infrastructure, and a dense urban fabric (with a large proportion of floating population) make Varanasi a relatable case study for India's cities.

Varanasi boasts of international repute; it ranks among the oldest continuously inhabited cities of



the world, and has received UNESCO'S Creative City of Music tag. In India, the city's significance is both cultural and mystical. Every year, millions of domestic and international visitors flock to India's spiritual soul, eager to absorb the sights and sounds of Varanasi.

The Challenges

Balancing the expectations of international audiences and domestic devotees against the needs of Varanasi's citizens has come with its own share of challenges. Virtually every part of India enjoys representation within the old Kashi area. This has generated challenges that affect identification, representation, coordination of city systems.

1. Balancing Varanasi's cultural and spiritual heritage with better administration, operations and holistic development
2. Mapping overlapping development that has congested the city over several centuries
3. Managing critical public service infrastructure, including assets related to water, sewage collection and treatment, street lighting, transportation, and parking services
4. Retaining and managing tourist footfall during the course of smart project implementation
5. Integrating Smart City projects with other ongoing development projects happening across the city

The Approach

A Special Purpose Vehicle (SPV) mechanism designs and manages IT and non-IT projects under the Smart Cities Mission. Here, Varanasi Smart City Limited (VSCL) guards the idea of rejuvenating the city of Varanasi into a great place to live and visit.

VSCL targets projects that uplift Varanasi's denizens, upgrade city infrastructure and living standards, and add value to Varanasi's core culture. The SPV will fast-track projects that conserve the city's enriched heritage, spirituality, and traditions, while supporting inclusive social or financial solutions.

Varanasi's Pan-City Project follows an area-based development model with the following sub-missions:

1. The Suramya Kashi component capitalizes upon UNESCO's City of Music label. It is rejuvenating the experience of Varanasi's historic temples and riverfront ghats.
2. The Nirmal Kashi component deals with earth-friendly initiatives. It is rejuvenating sacred water bodies and parks, while inserting efficiency and accountability into water- and waste management solutions.
3. The Surakshit Kashi component focuses on improving the police-citizen interface. It is creating safer public spaces, and proactive emergency response, through analytics-based surveillance.
4. The Samunnat Kashi component aims to create a properly skilled workforce that is healthy, and works healthily. It uses smart technology to establish market linkages to promote local artefacts, provide better spaces for work, and enhance the life and health of local workers.
5. The Ekikrit Kashi component digitizes Varanasi's services to ensure transparent access to information, and quality services for all citizens. It employs smart cards and mobile apps to make grievance redressal effective.
6. The Sanyojit Kashi component focuses on generating a customized model of transit and



“ We have been using GIS for over 20+ years for diverse use cases. While GIS technology has become pervasive across sectors, Smart Cities are the one who have leveraged this technology to the maximum. Since our Kashi Integrated Command and Control Centre has GIS at its core, we could turn this into an effective Decision Support System with 360 degree view of all city services, smart components and disaster management. ”

Dr. D. Vasudevan

General Manager (P&C), Varanasi Smart City Ltd.

transportation. It is easing congestion, improving last-mile connectivity, and diversifying modes of transport.

The Solution

A customised solution for Varanasi depended on the mammoth task of mapping and overlapping multiple datasets of the city's development. Accordingly, the SPV used ArcGIS Platform Technology to create an enterprise-wide integrated City GIS. In the process, multiple data sources and data levels became available for analysis, including information on administrative boundaries, public services, religious places, education and health, tourism and recreation, transportation, water bodies, and locations of infrastructure related to water, sewerage and drainage systems in the city.

ArcGIS Platform is the digital mesh that superimposes all smart components of the city over

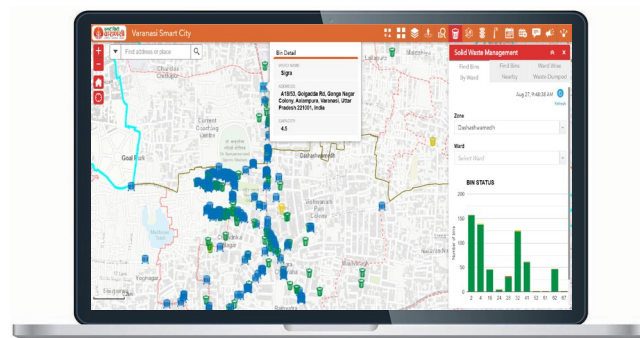
a common set of base maps. Some of the smart systems currently improving management and coordination of city services include:

1. Kashi Integrated Command and Control Centre (ICCC):

It uses location-based technology to manage traffic safety and city security. The ICCC has also proved to be a versatile mechanism for rapid emergency response. Most recently, authorities converted the centre into a COVID War Room to survey public places using CCTV, map COVID-19 positive cases using GIS, and locate healthcare workers using GPS.

2. Kashi Solid Waste Management System:

It optimizes waste pick-up facilities by using smart sensors on smart waste-bins. The sensors populate the City GIS by generating a real-time status of the bins, and statistical ward-wise overviews of waste dumps. This has helped coordinate waste management in the ward.



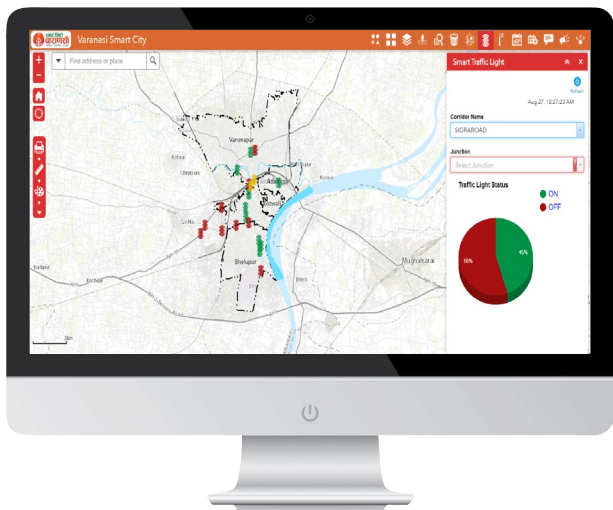
Smart Sensors on waste bins populate the City GIS with statistical ward-wise over views of waste dumps.

3. Kashi Environmental Monitoring System:

It maps a real-time feed of air pollution in different parts of the city. Air Quality Monitoring sensors provide valuable information that warns citizens of health-threatening conditions. It also allows authorities to attune traffic and industry with dynamic regulations that keep pollution under control.



4. Integration with traffic signals: In most Indian cities, malfunctioning signals invite traffic police to manage traffic, diverting them from their actual policing duties. Devoid of a holistic overview, this manual approach is cumbersome, piecemeal and problematic. In Varanasi, the city's GIS system networks smart traffic signals; this helps to identify malfunctioning traffic signals and traffic affected on particular corridors.



Smart signals help identify malfunctioning traffic signals on particular corridors, and generates an overview of how many signals are functioning properly.

5. Integration with smart streetlights: Real-time mapping of smart streetlights provides civic authorities with live updates on dysfunctional lighting. This promotes citizen confidence by ensuring safer public places that deter wrongdoing.

The Result

1. Actionable insight: Authorities use spatial analytics powered by GIS to harness real-time data, and design better decision support systems. In the process, authorities are gaining actionable insight for informed decision-making.

2. Improved business processes and workflows:

Smart integration of different features over a common GIS platform has standardised procedures across different departments. Inter-department collaboration has improved through geospatial mapping and geo-tagging of city assets.

3. Improved asset management:

An Enterprise-integrated GIS provides insights into use patterns of civic assets to improve urban planning in Varanasi. For water and sewerage systems, geospatial utility asset management is helping authorities operate and manage utilities in a better way.

The Benefits

The ArcGIS Platform Technology provides for customized solutions across different localities through IoT components. These integrated components generate thematic results in real time.

The system has also proven its flexibility for use in rapid response. In response to COVID-19, Varanasi generated GIS operation dashboards for health services, heat maps for containment zones, and CCTVs to monitor citizen movement and social distancing. The Platform also helped manage health response; it used drones to sanitize hotspots, established telemedicine facilities for remote health care and diagnosis, while also analysing infrastructure availability to address the health crisis.

Better and location-customized experiences await all citizens of Varanasi. Beyond improving the urban environment, GIS has now equipped the city with options to minimise air pollution, improve water management, create safer public areas, and respond intelligently to emergencies. The technology is steadily ensuring that city's culture maintains its rich heritage while assuring Varanasi's denizens the benefits of a new Indian urbanism.