Slum Atlas 2.0: GIS, Drone Mapping and Socio-Economic Survey of Slums in Pune

As part of its vision of promoting community development through public participation, Maharashtra Social Housing and Action League (MASHAL) implemented the Slum Atlas 2.0 Project, a comprehensive GIS-based mapping and socio-economic survey initiative covering slum settlements across Pune city. The project was conceptualized as an advanced extension of the original Slum Atlas of Pune, which was released in 2012 by the then Hon'ble Chief Minister of Maharashtra.

The objective of Slum Atlas 2.0 was to document and analyze the physical, demographic, and socio-economic changes that had occurred within Pune's slum settlements over the previous decade. While the earlier mapping and survey exercise was conducted between 2007 and 2011, the updated initiative incorporated modern geospatial technologies, including drone-based surveys, to generate accurate and up-to-date information on urban informal settlements.

At the time of the project, Pune city comprised five administrative zones, fifteen administrative wards, and approximately 486 identified slum settlements. The project generated a comprehensive database and spatial information system that could support urban planning, service delivery, policy implementation, rehabilitation initiatives, and research activities related to slum communities.

The information generated through Slum Atlas 2.0 was designed to serve a wide range of stakeholders, including government agencies, urban planners, academic institutions, researchers, civil society organizations, CSR initiatives, and community-based organizations. The project significantly improved the ability to identify, locate, and understand households and settlements within densely populated urban slums, thereby facilitating more effective development interventions.

Key Outputs of the Project

The project generated a range of advanced geospatial and socio-economic datasets, including:

- High-resolution 2D ortho-mosaic maps of slum settlements.
- Three-dimensional (3D) settlement models and point cloud datasets.
- Digital surface models providing detailed visual and elevation information.

- Updated survey information for all 15 administrative wards of Pune city.
- Drone-based aerial imagery and spatial documentation of slum areas.
- Highly accurate image processing outputs with horizontal accuracy of approximately 1 cm and vertical accuracy of 2–3 cm over hard surfaces.

Methodology Adopted

Phase 1: Slum Identification and Database Preparation

MASHAL prepared a comprehensive inventory of all identified slum settlements across Pune's fifteen administrative wards. Information relating to population, number of structures, settlement area, and geographic location was compiled and verified before commencement of field activities.

Phase 2: Drone Survey and Image Processing

After obtaining the necessary permissions from relevant authorities, including local law enforcement agencies, drone surveys were conducted across identified slum settlements. Advanced drone technology and image-processing software were utilized to generate:

- High-resolution aerial imagery.
- CAD-based settlement drawings with contour information.
- House numbering systems.
- Roof area measurements.
- Roof typology classifications (RCC, tin-sheet, and other materials).
- Building height and floor information.

The outputs were integrated into digital roof plans and spatial databases linked with settlement-level information.

Phase 3: Spatial Mapping and Infrastructure Documentation

Detailed GIS and CAD drawings were prepared incorporating key physical and infrastructure features, including:

- Roads and internal pathways.
- Contour lines and topographic features.
- Manholes and drainage systems.

- Trees and open spaces.
- Rivers and natural water channels.
- Residential and commercial structures.
- Roof-level building plans.
- Railway lines and transport infrastructure.
- High-tension electric towers.
- Road dividers and footpaths.
- Slum boundaries.
- Survey numbers and land parcel boundaries.
- Gut number boundaries and related cadastral information.

Phase 4: Ground Verification and Lane Demarcation

The roof plans generated through drone surveys were further validated through extensive field visits. MASHAL's survey teams conducted ground-truthing exercises to prepare detailed footprint plans and demarcate:

- Internal lanes and access roads.
- Community facilities and public amenities.
- Temples and religious structures.
- Health centres and hospitals.
- Street lighting infrastructure.
- Police chowkis and security facilities.
- Post offices and public service centres.
- Community and public toilets.

Phase 5: Cluster-Based Numbering System

To improve settlement management and survey accuracy, slum areas were divided into clusters, each comprising approximately 150 households. A systematic cluster-based numbering methodology was adopted to facilitate household identification, mapping, and data management.

Phase 6: Household Socio-Economic Survey

MASHAL conducted an extensive door-to-door household survey covering residents within the identified slum settlements. Information collected included:

- Name of household head.
- Contact details.
- Status of electricity connection.
- Availability of water supply connections.
- Access to LPG or other cooking fuel sources.
- Availability and usage of toilet facilities.
- Aadhaar and PAN card details.
- Occupancy status (owner-occupied or rental).
- Additional socio-economic observations and remarks.

The household survey data was digitally linked with geospatial maps, ensuring that each surveyed structure and household could be accurately identified and referenced within the Slum Atlas database.

Project Significance

The Slum Atlas 2.0 Project represented a significant advancement in the application of GIS, drone technology, and socio-economic data collection for urban development planning. By integrating spatial mapping with household-level information, MASHAL created a robust evidence base for informed decision-making, infrastructure planning, social welfare targeting, rehabilitation initiatives, and sustainable urban development in Pune’s informal settlements.