

GIS BASED ASSET MAPPING, UTILITIES INFRASTRUCTURE MAPPING, CONSUMER MAPPING, TOPOGRAPHIC MAPPING & 3D MODELLING IN AN INTEGRATED MANNER

Supriya Thul¹, Sohan Kanse², Pallavi Sonsale³, Mayur Chaudhary⁴

^{1,2,3,4}UG Student, Dept. of Civil Engineering, Datta Meghe College of Engineering, Maharashtra, India.

Abstract - Efficient Integration of Utilities, Assets, Consumer and Topography with Geographical Information System is the key to effective management. Regulations, operation and maintenance of particular city, Industrial park and commercial zone with GIS integration, we can better visualize our data and keep check on every aspect in every possible way in locality. GIS helps water, sewer and other underground utilities authorities to overcome the on-ground difficulties & challenges of operation and maintenance for effective decision making. In Urban planning, third dimension plays the unique and important role. Using 3D GIS, modeling it offers a unique flexible interactive data for urban planners while providing one of the best representation of data for planning and decision process. The primary objective is to improve real time problem solving, problem identifying system on a centralized server for effective operation, maintenance and further expansion using 3D GIS dataset. The paper describes the approach to develop GIS based asset mapping, utility infrastructure mapping, consumer mapping, topographic mapping, 3D-modelling in an integrated manner through spatial data integration, field verification and final analysis. This exercise is done initially for MIDCs Millenium Business Park at Mahape. The process of schematic mapping and data conversion using Consumer survey, DGPS, and Drone Survey, CAD maps, entered in GIS will ensure the accurate and sufficient information and data for effective management.

Key Words: Spatial, Assets, Utilities.

1.INTRODUCTION

As Urban population is increasing day-by-day. It is forecasted that till 2050 Urban population in India will be doubled of today's. To tackle this problem as early as possible Government of India in 2015 launch a prestigious project for developing 100 smart cities all over the country. Development of Smart cities will use all smart operation and automation system for improving ease of living. Cities from all over world already started to thing and actually work on developing Smart Cities. Apart from developing new cities Government of India additionally launch "Amrut" scheme to strengthen the infrastructure of existing urban towns. Every municipal organization or any administration body which deals with consumer, assets and utilities need to have dataset in spatial formats. Lack fully still many Municipals have hardcopy maps of existing utilities, and assets which becomes tedious to uniquely locate on site Assets or utilities. On the other side this organization face a significant daily

challenge for operating and maintaining the network and increasing their productivity. To understand this carefully it is necessary to uniquely identify every feature, spatially locate it with unique code for easy location of feature which helps in easy routine maintenance. Earlier these datasets were maintained too hectically and in complex format with different software's for different network. Nowadays with GIS one can easily retrieve and integrate data with unique identification for quick time emergency response system for ease of living. Which can also manage all utilities assets and consumers in one centralized location. Maps have been used for thousands of years as a tool for sharing data. data on a map is presented in a graphical format on paper or more recently as third dimensional display on computer screens and electronic means. Maps carry spatial data which is information about the location and shape and relationship among geographical features usually stored as coordinates and topology. GIS based Asset, utility and consumer management system which will enable the user to know precisely where assets, utilities (including underground utilities) and consumers are located in the need of the hour. Using GIS based integrated management system for this, will give the user more accurate reflection of real-world circumstances and will allow such organization to make better effective decisions. This will also equip users with an effective tool for physical planning. (e.g., Infrastructure planning, Excavation planning, maintenance plans and breakdowns.

1.1 Characteristics of existing system

1. All engineering information which includes specification of pump houses, sewage treatment plant (STP), lifts, buildings, roads, different features like water supply, sewage lines, fire lines, electric line and service connection to each consumer, etc. are maintained in disintegrated manner.
2. The data for water supply, firefighting, drainage details of buildings, roads, pump houses, well houses, trees, electric cables and street light poles is maintained through separate map sheets with facilities data printed in text form, these maps are rarely updated and there is lack of linkage between spatial and non-spatial data.
3. Any decision regarding maintenance of building, roads, utilities infrastructure, streetlight poles, etc. are made on rough basis as data are available by reading sheets and referring to old data is difficult.

4. All utilities are located at different places in the Business park; hence, data is not centralized and it is only available in CAD format and not spatially connected.

5. There is no facility available for measurement of roads, size of building, length of cables, length of water supply line, length of fire supply lines, sewage lines or any utility pertaining during any breakdown of any line.

6. There is no spatially computerized system available.

1.2 Objectives

The main objective is to develop a GIS based management system and develop an integrated system for query and analysis. The detailed objectives are

1. Study of the existing management system. purposes.
2. Design and development of a spatial database for GIS based Integrated management system.
3. In situ data collection and verification for utility, asset and consumer mapping of an area of interest.
4. Customization and integration of onsite data using GIS.
5. Centralizing dataset for operation, maintenance and future expansion.

2. LITERATURE REVIEW

GIS Integrated Mapping is one of the main topics in Geographic Information System. There are many research efforts put previously. Salah Muames Aburawe and Ahmed Rodzi Mahmud presented a unique GIS detection system by introducing 'Water Loss control and real time leakage detection system using GIS' which can be concluded with the leakage size and location in the pipe network was predicted which depends upon the pressure and flow rate using SCADA (Supervisory Control and Data Acquisition). The network was completely mapped using GIS in an integrated manner for efficient use of system for operation and maintenance. Rajeshkumar J Ajwaliya and Shashikant Patel created an integrated utility management network for a DOS housing colony, Vikramnagar, Ahmedabad, they created GIS integrated mapping of utilities for an efficient unique identification of each utility on ground. this approach gave many researchers a vastness of applications of GIS in Urban planning and integrated network in smart cities. Richard Greens and G.V. Loganatham further put the idea of using GIS for a server system design. The program that was develop using GIS uses the user specified manhole's locations to generate sewer network. The GIS is used to analyze the areas topography surfaces features and street network to delineate sub watersheds to locate pump stations and to determine the path for the fore main. Husam Musa Baalousha further put forward the study of Mapping groundwater contamination risk using GIS and groundwater modelling. In which she elaborated the risk map created in this study can be used in the development of land management policy, locating high pollution potential sources (i.e., treatment plants, landfills, etc.), implementation of a mitigation strategy and reduce groundwater pumping and

gradually secure water from alternative source such as Desalination

3. METHODOLOGY

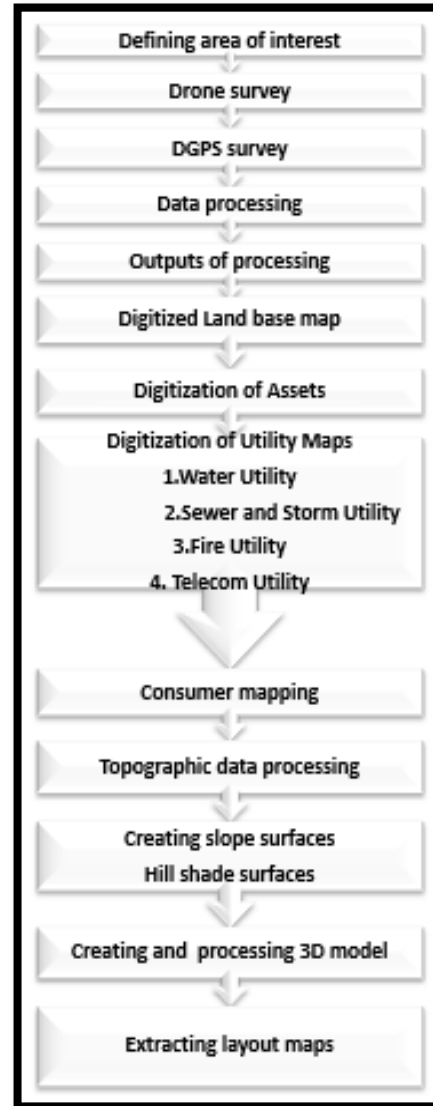


Fig 1 Methodology.

3.1 Study Area

The Millennium Business Park, Mahape is embedded in Thane District of Maharashtra. The study area lies between 19° 11' N, 73° 01' E. It is an area of 18.71 hectares and about 300 to 350 Industries and 1 to 1.2 lacs Daily Working Professionals. as per the Consumer Survey connected by us. Average altitude of MIDCs Millennium Business Park, Mahape is 18m above Mean sea level. The average annual Rainfall of Region is 2000 to 2500mm. The step-by-step procedure for creating an integrated mapping of MIDCs Millennium Business Park is shown in fig 1.

3.2 Defining Area of Interest

Identifying the administrative boundary of Millennium Business Park, Mahape by some round of Sittings with officials of MIDC, & Locating nearby Landmarks and positions of Important centres nearby.

3.3 Drone Survey

Flying Drone at 80m Height, for capturing High Resolution Ortho Image, DSM & DTM of Millennium Business Park, Mahape of 2cm Precision.

3.4 Data Processing

After capturing Drone Images and DGPS data points, Data is processed for nearly 6 to 7 hours for obtaining the required outputs.

3.5 Digitized Land Base Maps

After inputting, the following data in ArcGIS, firstly the digitized Base map was prepared where Landmarks, Boundaries, Open spaces, Ward/Sector Boundaries, are represented.

3.6 Digitization of Assets

After assets were identified on ground, they were hyperlinked and uniquely identified on ArcGIS, the Digitization by creating Shape file was done and attribute table was formed by information collected by on ground realities.

3.7 Digitization of Utilities

Existing Utilities Infrastructure were studied and identified on ground. Then, the existing AutoCAD plans were Geo-referenced, and Base maps were created. After digitization, Utilities were verified on ground & necessary alterations were carried out on Digitized Maps.

3.8 Consumer Mapping

Door to Door Consumer Survey was carried out at complete Industrial Park to get the updated current information and status of park. Complete information was linked with ArcGIS in a well-organized manner.

3.9 Topographic Data

Processing After processing of DGPS data, the Contours were created and unwanted Contours were deleted and polished, & Topographic data were further analyzed for slope calculations. Polishing of Contours, Raster surfaces of Hill shades and slopes were created to identify the causes of water-logging and effective management of utility networks.

3.10 3D Modelling

In city planning managing, the third dimension is becoming a necessity. 3D GIS modeling offers a flexible interactive system while providing one of the best visual interpretation of data which supports planning and decision processes for city planners. As a result, 3D GIS

model expresses terrain features in an intuitive way which enhances the management and analysis of a proposed project through 3D visualization.



Fig 2 GIS based 3D Modelling for MIDCs Millennium Business Park, Mahape.

3.11 Extracting Layout Maps

Maps are the geographic container for the data layers and analytics you want to work with. GIS maps are easily shared and embedded in apps, and accessible by virtually everyone, everywhere. Layout maps of ArcGIS gives far more realistic experience than AutoCAD maps, and gives Real time interpretation in quick time. Since GIS mapping technology allows you to turn data layers on and off, it can be used either to focus on specific data elements or to view new combinations of elements

4. APPLICATIONS

The quality of life in a locality largely depends on the availability of infrastructure such as water supply, waste disposal, road infrastructure, communication facility etc. Queries can be made on assets considering their accessibility from the nearest distance. Specifications of each utility network can be obtained from the tables. By clicking on several points in each locality, information of the material, size and length, of each utility infrastructure, can be obtained. By using GIS Query can be fired and area of damage, Utility near locality, & Road specification nearing your locality can be identified, which can be useful for further expansion and daily day to day operation of Millennium Business Park, Mahape.

5. RESULTS

MIDCs Millennium Business Park Mahape was mapped using ArcMap, and 3D processing of model was prepared in Arc Scene for better optimization and visualization and easy understanding by Layman. There were almost 300 to 350 Industrial Units with Water & Telecom supply connection to each unit. Utility Network was uniquely Numbered and identified uniquely on ground. Layout Maps were prepared for each Utility of Scale 1:1200. A total of 4 Utilities were mapped, Contour map of locality was created by mapping 55 Assts on it and about 300 to 350 Consumer units. 3D Modelling with mapping all utilities and Consumer for easy real time solution for identifying locality on ground and quick time problem solving.

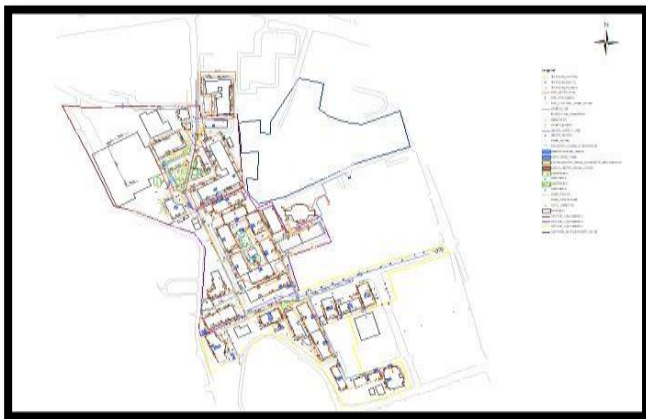


Fig 3 GIS based integrated mapping OF MIDCs Millennium Business Park, Mahape.

6. CONCLUSIONS

Developed GIS model has been designed to manage utilities, assets for MIDC Millennium Business Park, Mahape. The developed utility management system may provide a wide range of data for various types of analysis to enable routine maintenance and management. Strength of GIS is integrating data and preparing it for analysis or modelling apart from tying together data from various sources makes it an important tool for the planning and decision making. User can get legend of all layers displayed on map for accurate interpretation of maps. Data-set will display unique coordinate of the current mouse position and the unique coordinate value will change with the movement of mouse pointer over the area of interest. User can see co-ordinate only if the mouse pointer is inside the map area. We can measure length of cable, roads, water supply line, firefighting lines, drainage lines, form one place and another place in entire MIDCs Millennium Business Park, Mahape. User can command to get any layer of the GIS map to get attributed data for a particular feature of that particular layer. User has to click on any feature of a particular layer to get the attributed 5 table of that feature. GIS provides a wide range of solutions from setting up distribution network and load management to customer information, assets management,

billing and customer services. Digital system provides timely, accurate and easiest way of acquiring data & information, which is very vital in taking effective and accurate decisions.

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