

“GIS Centric Utility Management System”

Sr. Technology Lead, NSG India Pvt. Ltd.

Plot: 5, 1st Floor, Ganapathi Arcade, Op: Omega Degree College, Beside Radhika Theater ECIL Post, Hyderabad- 62.

Contact: +91 40 4011 9590/9690., 040 2713 3448

Abstract:

Technical and Commercial losses are of major concern in the power utility sector. Govt. of India has proposed R-APDRP project with a focus to program on actual, demonstrable performance in terms of sustained loss reduction. It is required to establish reliable and automated systems for sustained collection of accurate base line data, and adopt of Information Technology in the areas of energy accounting. GIS play a key role in developing accurate database, improve internal efficiency levels pertaining to power supply monitoring, commercial and customer services. GIS is also extremely useful for important functions like network analysis, facility management, energy audit, trouble call management, load management, theft detection etc. GIS integrated with other systems provides timely, accurate and easier way of acquiring information, which is very vital in taking prompt and accurate decisions necessary in the economic development of any enterprise. This paper talks about design and development of a GIS centric management system which serves as the graphical focal point for information on the distribution networks. This integrated system aims at improving the functioning of the electric network management through better planning, maintenance and customer service. GIS centric utility management system designed and developed by integrating with other systems like CRM, CCC, Network Analysis, AM/MM, MDAS etc.

About the Author:



Mr. Raparthi Srinivas

Srinivas R is a Performance driven professional with 15+ years of experience as Senior Solution Architect. Specialized in ESRI technologies, has experience in varied GIS technologies. He carries experience in providing technical solutions across various domains like Utilities, Municipalities, e-governance etc.

E mail ID: srinivas.raparthi@nsgindia.co.in

Contact: +91 9959387309

Introduction

The GIS (Geographical Information System), in co-ordination with GPS (Global Positioning System), and Remote Sensing technologies have evolved over the last two decades, as the three most important spatial database technologies for developmental planning and decision support. Remote sensing is used for real time and accurate data capture. GIS provides a useful way to visualize a set of registered map layers or themes, all registered together to a common map base or geographic area.

Over the past few decades, the power industries have been developing power distribution systems to follow up with the rapid growth of the power demand. Power utility consequently has to manage various assets of the distribution network like poles, power lines, transformers etc. In addition to the management of assets it is important for the power distribution company to supply continuous and quality power to their customers. In addition to quality power supply to the consumers, it is the objective of the distribution companies to reduce the technical and commercial losses.

Geographic information along with the distribution network data play a key in to efficiently manage the distribution system for providing a reliable service. It is required to manage geographic information, which can help engineers to operate the system as per the requirement. Using GIS, the entire electrical network can be overlaid on a vector base map. In most of the DISCOM's, data pertaining to various assets of the distribution network like the substations, HT & LT distribution; street lights etc. are maintained in hard-copy maps. During interruption of the power supply, power failure, break down of feeder and shut down for maintenance purposes, it is very difficult to trace the exact location of the fault. Traditionally all Engineering information pertaining to the Electrical Substation which includes specification of substations, street light etc. were maintained only on hard-copy maps. Development of a spatial database for power distribution networks and assets has become a requirement for engineers of power distribution applications like power line information, buildings, equipment and network structures, fault identification at the time of emergency, and load flow studies. A database of electrical equipment and network of the electrical system is not centralized thus database updating is a critical issue. Geographical Information System (GIS) technology plays an important role in mapping the HT/ LT power lines and electrical network assets, on a geographical jurisdiction, to help engineers to find connectivity of cables. A GIS environment provides the facility to create, store, manipulate and analyze the spatial database.

In addition to the assets of distribution network, GIS can effectively manage customer information describing the attributes of each customer such as location, pole number, service account number etc. Discoms are already finding GIS very useful system in management of distribution network. The electric utility industry has realized that GIS is a valuable tool not only for mapping facilities but to improve decision [3-4] making and better managing infrastructure.

This paper talks about GIS Centric Utility Management System developed for R-APDRP project with a focus to program on actual, demonstrable performance in terms of sustained loss reduction. The application is developed on ArcGIS Server, ArcFM server, Geocortex Essential, SQL server technologies. The application is a useful way to visualize it as a set of map layers or themes, all registered together to a common map base or geographic area. DISCOM has to keep track of numerous poles, circuits, power lines, and transformers. Information of location, voltage, and distribution of electricity of these facilities seem to be very overwhelming. However, with the use of GIS, information can be better organized on a computer system linking the database to map. A GIS as well can make the information easily updatable and accurate and hence can cater to the needs of maintaining large power infrastructure.

Business Benefits of the Solution

- Reduction of AT & C losses
- Improving customer satisfaction
- Increasing reliability & quality of power supply
- Identification of the Customer on the network using K.No, Account No so that Utility can reach the Customer fast for operation and maintenance
- The ability to identify the area served by a Feeder by using tracing tool
- The ability to generate the Single Line diagrams for HT and LT networks based on the near real time data
- The availability of the latest Network data in the system
- The identification of Change over points
- The ability to generate the optimal route plan for the meter reading, maintenance works
- The ability to conduct the feasibility analysis for New Connection, the estimation of technical losses
- The ability to measure the lengths of the proposed lines and hence in the preparation of cost estimates before approval

GIS & ArcFM Functionalities

- GIS Map Viewer
- Viewing of Network Data

- Base Map for both Land base Data & Satellite Image
- Basic GIS Navigation Tools
- Mark up tools
- Add, Edit, Delete Graphic Point/Line/Polygon
- Add, Edit, Delete Graphic Text
- Printing & Export Maps
- Locator Search
- Analysis Tools (Attribute, Spatial Query Builder)
- NIN Search
- Consumer Search
- Customer Data Display on Map
- Electric Tracing Tools
- Network Editing Tools

Locator Search

Locator tool is used to locate the various features on map. Locating features can be done in 3 ways like Feeder Manager, Locator Primary, XY Coordinates. **Feeder Manager** is used to search the features on the map using the Area Board, Circle, Division, Sub Division, Section, Substation, Feeder, DT and LT etc. **Locator Primary** tool is used to locate the features using a primary control of the layer, each layer will be having its own primary control. **XY Coordinates** tool is used to find the features in a specified buffer from a particular place on the map.

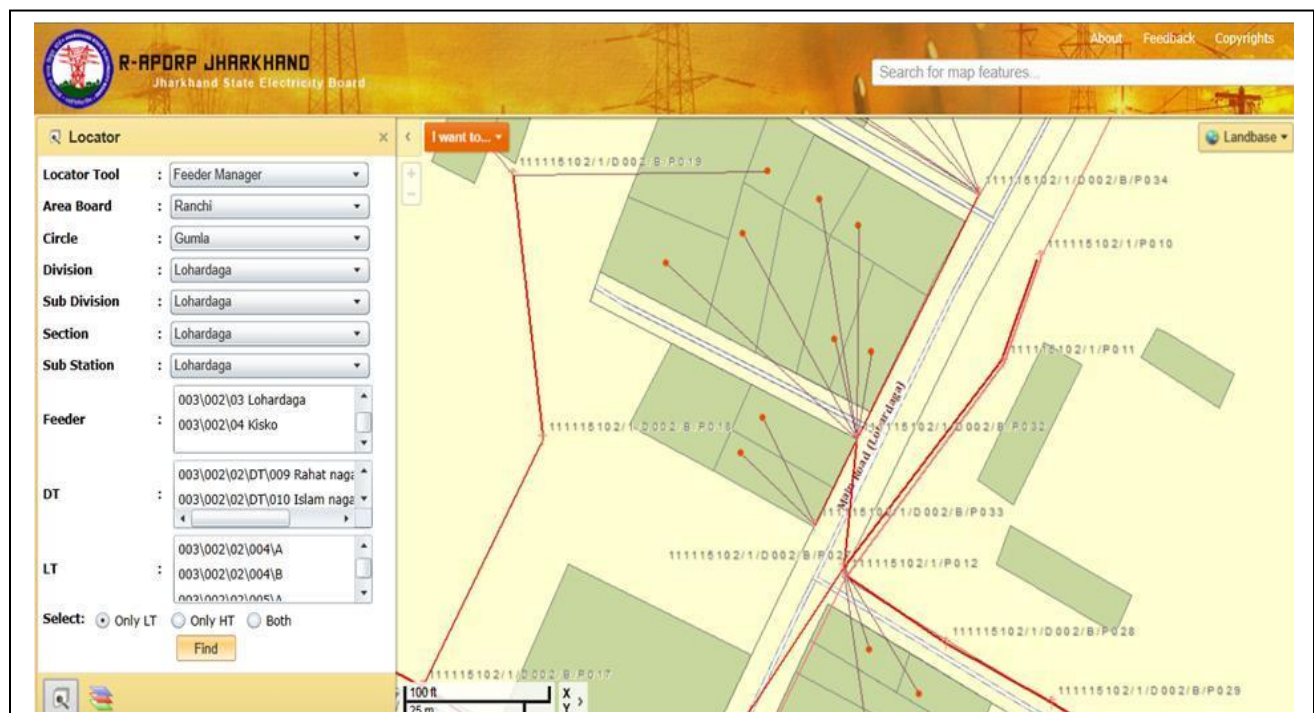


Fig: 1 – Locator Search

Consumer Search

Consumers Search allows user to view the Consumer information on DT wise, Substation wise, Division wise, Building wise etc.

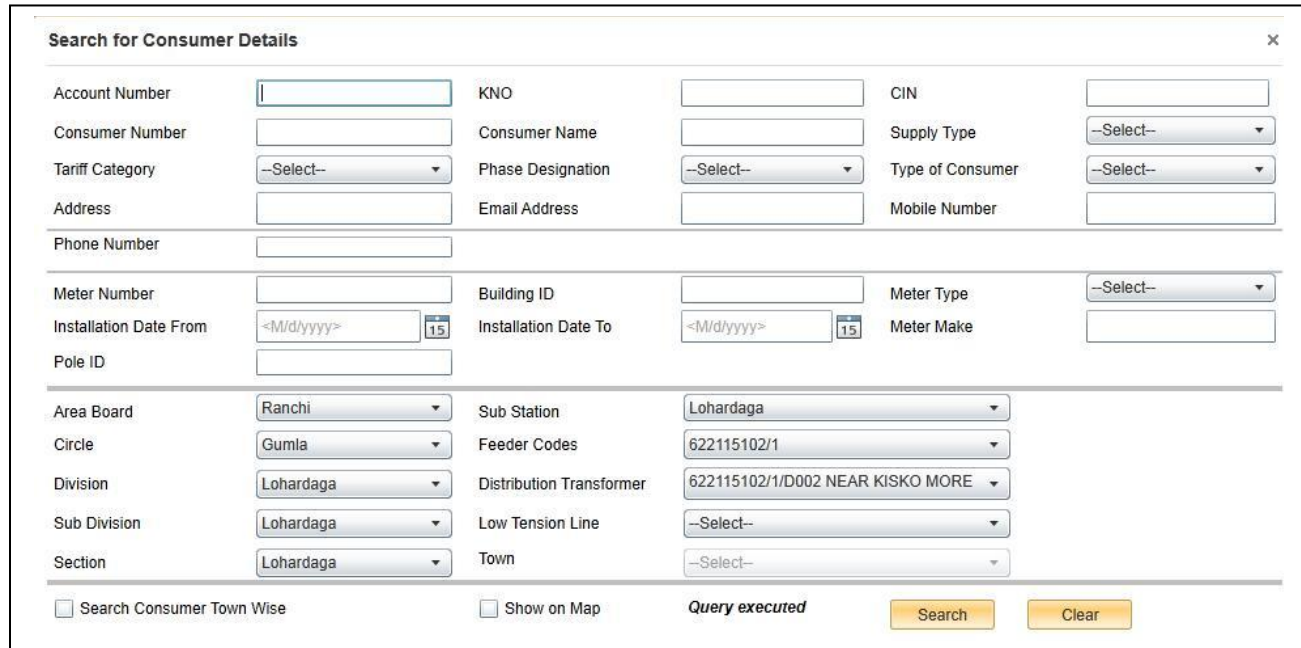


Fig: 2 – Consumer Search

Electrical Tracing

Electric Tracing allows the user to visualize and inspect the topology and normal switching state of an electric distribution network. Outage management, system planning, design, analysis and construction are all areas in which the electric trace tasks can be utilized.



Fig: 3 – Tool bar developed for Electrical Tracing

Downstream Trace allows the user to perform the tracing in downstream. The Downstream trace searches for circuit sources in all directions from each end of the flagged edge.

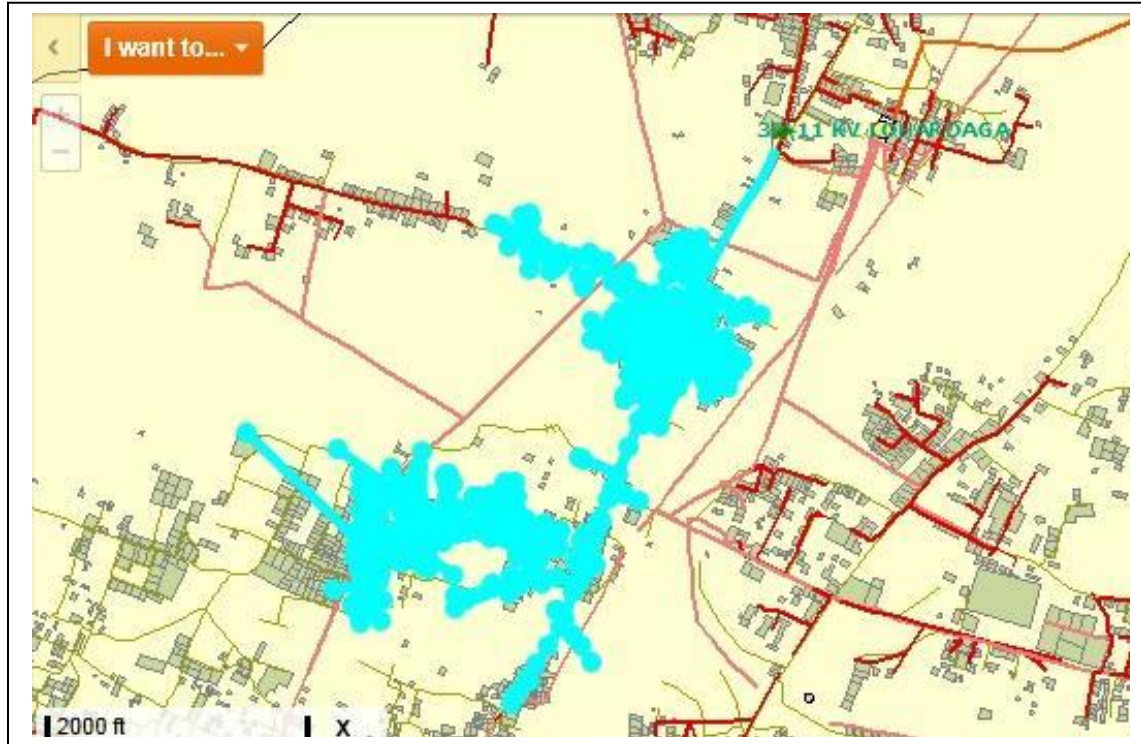


Fig: 4 – Typical Downstream Performed on Electrical Network

Upstream Tracing allows the user to perform tracing in upward direction from the Flag.

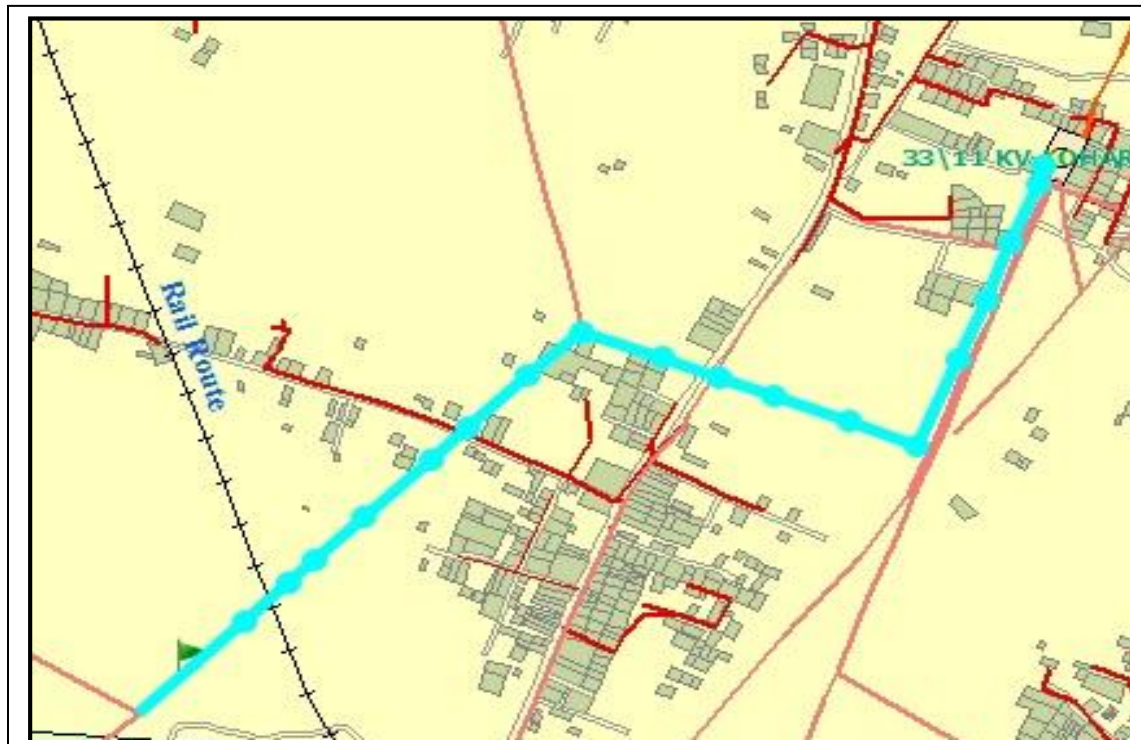


Fig: 5 – Typical Upstream Performed on Electrical Network

Network Editing Tool

Network editing tools allows the user to draw the features like Line, Cable, Support Structure and Service Points on map in versioned map and it reflects the updated changes into default version after reconcile and post.

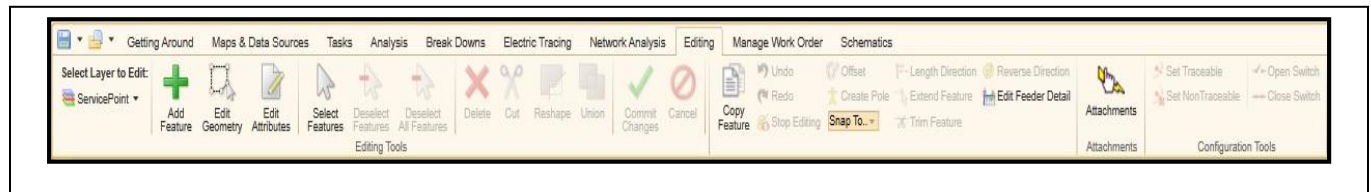


Fig: 6 – Tool Bar developed for performing Editing Operations

GIS Application Integrations with other systems

Application provides the interfaces for integrating with various systems in Electrical department, all the integrations between GIS and other system are done through WCF services.

- CRM
- Customer Care Center (CCC)
- Asset Management & Material Management (AM & MM)
- Document Management System (DMS)
- Network Analysis
- Meter Data Acquisition system (MDAS)
- Energy Audit (EA)

Conclusion

Using GIS applications power companies can collect and store a large amount of data that can be readily accessed and analyzed. Strength of GIS is integrating data and preparing it for analysis or modeling apart from tying together data from various sources makes it an important tool for the planning and decision making. User can display legend of all layers displayed on the map. This legend will be represented by the symbol of each layer with color and the name of the layers in a list. System will display coordinate of the current mouse position and the coordinate value will change with the movement of mouse pointer over the map area. User can see co-ordinate only when the mouse pointer is inside the map area. If the mouse pointer goes outside the map area then the system will not display the coordinate. User can query any layer of the GIS map to get the attribute data for a particular feature of that layer. User has to click on any feature of a particular layer to

get the attribute of that feature. GIS provides a wide range of solutions encompassing the entire business value chain in the power distribution sector from setting up distribution network and load management to customer information, assets management, billing and customer services. Digital system provides timely, accurate and easier way of acquiring information, which is very vital in taking prompt and accurate decisions.

References

1. Surendra Kumar Yadav, : GIS in Power Sector Management, International Journal of Engineering Research and Technology, ISSN 0974-3154 Volume 6, Number 6 (2013), pp. 759-766
2. Rajeshkumar J. Ajwaliya, Shashikant Patel, "Design and Development of GIS Based Utility Management System at DOS Housing Colony, Vikramnagar, Ahmedabad", a Int. Journal of Engineering Research and Applications, ISSN : 2248-9622, Vol. 4, Issue 9(Version 6), September 2014, pp.56-73.
3. G.W. Ault, C.E.T. Foote, J.R. McDonald, "Distribution System Planning in Focus", IEEE Power Engineering Rev., Vol. 22, pp. 60-62, January 2002.
4. M.M. Fischer, Y. Leung, editors, Geo-Computational Modeling. Techniques and Applications, Heidelberg: Springer-Verlag, 2001.