

GIS application in Power Distribution Utility

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Introduction

Development of geo-referenced consumer and network database has become a necessity for a host of power distribution applications like customer information system, asset management, trouble call management, billing system, energy audit and load flow studies. The Power Distribution Companies constantly engage in updating their consumer data and the corresponding electrical network attributes. Geographical Information System (GIS) technology plays an important role in mapping the HT/ LT consumers and electrical network assets, on a geographical base map, to help define the consumer's electrical connectivity. Using GIS, the entire electrical network can be overlaid on a satellite image or a vector base map, with the facility for zooming, resizing and scrolling.

Getting started

To start developing a GIS map for power distribution network, a GPS survey becomes necessary for geo-referencing and mapping the relevant electrical assets on the digital base map. In some GIS applications, even the consumers are mapped to the corresponding electricity network. The purpose of such application is to index all the consumers and categorize the complete consumer database with respect to their unique electrical address.

A successful GIS implementation seamlessly integrates the spatial data with various utility applications - Customer Information System, Assets Management, Outage Management and Utility Billing System and provides interfaces for cross-application data portability.

Digitization process

The digitization of electrical network assets, consumer indexing and network mapping involves the following steps:

1. GPS survey of electrical consumers and network assets: This involves the Identification of all consumers and their service connections, followed by the preparation of GIS base map.
2. Digitization of electrical network assets (Substations, Feeders, Transformers and Poles): Differential GPS is preferred to establish geo-coordinates with acceptable accuracy. Then the electrical connectivity with reference to the Pole, Transformer, Feeder and Substation is plotted on the base map.
3. GIS mapping, indexing and codification of electrical consumers and network assets with defined electrical relationships: This requires collection and updating of data of consumers along with their electrical connection attributes.
4. Interoperability and data portability: The following utility applications are required to be integrated with the GIS application:
 - a. Customer Information System
 - b. Asset Management System
 - c. Trouble Call Management System
 - d. Utility Billing and Energy Accounting System
 - e. Load Flow and Load Growth studies

Data collection

Availability of accurate GIS-based distribution network map showing the geo-coordinates and network configuration is an important prerequisite for analysis, planning, optimization and load flow studies. Proper GPS survey and creation of an accurate digital base map for the distribution network is essential for a successful GIS implementation. The survey requires a GPS Base Station at a pre-determined location, aided by adequate number of GPS Rovers/ Receivers. Surveyors walk along the HT and LT feeders and capture the spatial position of the Pole, Transformer, Feeder and Sub-stations. The attribute data of the distribution network is also collected in the process. Differential correction is then performed on the spatial data thus captured.

The digital base map must show the important landmarks like Roads, Rivers etc. which is necessary for easier identification of network assets and plan new distribution network. For better visualization, the vector map of the network can be overlaid on the digital base map or a satellite raster image.

GIS Integration

The GIS application must facilitate on-line query with a graphic display of network section, showing the particular network element and their attributes. The GIS application must be able to stitch together contiguous maps sections on the same scale into a continuous mosaic. With GIS integration, the Customer Information System (CIS) provides the complete information of the consumer and the network map leading to the source from which the consumer is supplied electricity. This information can be used for Energy Audit, Load Management, Network Planning and analysis.

Conclusion

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. However, the interfaces between GIS and other utility software applications should be well-defined. Continuous updation and monitoring of data is critical in any GIS application. Therefore, it is important to have in-built process control checks, audit trail and exception reporting facility to ensure reliability and accuracy of data.

About the author:

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He has served in various NTPC Power Stations at Badarpur, Rihand, Dadri and Auraiya, executing several key projects in control systems and process automation including SCADA, DDC/ MIS, Real-time systems and core IT applications for the Power Sector. He was awarded meritorious service award at NTPC, Dadri.

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