

Management Of Distribution System Using GIS

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Abstract

Electricity is considered as an essential need for our daily life. The power distribution companies manage the power distribution system safely and efficiently. Efficient functioning of distribution company is important to sustain the development of power sector and economy. Hence there was a need for some latest and modern systems to be utilized for improving the reliability and efficiency of power sectors. GIS(Geographical Information System) came into existence as an powerful and effective tool for management of transmission and distribution system. The GIS aims to sign-out the suitable locations that are to be fed with power supply. GIS is Useful in development of accurate database, monitoring of supply and its control, analysis of commercial and customer service, energy audit, trouble call management, load management, theft detection etc. GIS technology helps the survey respondents to answer their smart grid questions and address smart grid challenges. GIS makes the smart grid smart because GIS works with data on an interactive map where it can be updated, understood, and shared."

Keywords: Power, Geographical information system, control, management.

I. Introduction

A distribution system is one of main part of the power system. It is necessary to carefully consider technical issues, the impact on natural environment, the effect on local communities, and various regulations. However there are various issues coming up like power theft, poor distribution, complexity in network planning etc, power distribution system consequently has to keep the record of numerous poles, circuits, power lines, and transformers. However, it has become difficult and hard to record due to the complexity of the networks..

A solution to these problems is the GIS which is a graphical advanced version of scada where electrical(technical) parameters of system are displayed on graphical map with respect to its physical locations (point of connection). Also social commercial environmental effects become part of same information system.in normal display system only technical parameters are given importance whereas in GIS, collective approach for parameters as well as its effects on surroundings is followed

II. Challenges Faced By Distribution System

Use of modern equipments and growth of automation demands better quality of power. Hence with the power distribution the power quality has also been taken into consideration by the electric utilities.

There are various Challenges faced by utilities which are as follows:

- [1] There is a large gap between supply and demand due to shortage of power
- [2] Lack of effective management, control and proper communication.
- [3] Transmission & Distribution losses are more which are up to 45%.
- [4] Power quality issues such as interruptions, flickers and poor voltage.
- [5] Revenue collection is poor due to which financial losses are higher.
- [6] Modernization is not possible due to less investment in power sectors.
- [7] Most of the substations and transformers are affected by overloading.
- [8] Employees neglect the problems of consumers due to monopoly in power sector. [1]

Most of the electric utilities faced the problem of storing the historical data and adding the new data which was recorded due to some dynamic changes on the field. Moreover the problem of storing of the voluminous data and maintaining the consistency of it was a major challenge faced. [4]

III. Current Existing Distribution System

Generation, transmission and distribution are the main parts of power system. The structure of transmission and distribution system covers a huge network consisting of a wide range of equipment, feeders and services. Each system has its different and unique role. Typical systems used in the electrical utility are SCADA, DMS, NA and

ERP. SCADA system consists of a complex network of electronic measuring and sensing instruments for capturing the data which is communicated over LAN and WAN to the control center. SCADA carries out the function of monitoring the utility network in real time and provides the remote control of switching devices, transformers and equipments. This facilitates utilities to carry out the maintenance and fault rectification activities of the distribution system. DMS (distribution management system) supports operational improvements by using online network and is used to efficiently manage the 11KV and below network by providing planned switching orders and load flow analysis to minimise losses and equipment overloads. [4]

Traditional SCADA systems are early smart grid technologies. However the use of SCADA is limited to a few substations and major distribution automation devices. The data management by SCADA plays an important role in any smart grid implementation.

The combination of smart meters, data management, communication network, and applications specific to metering is advanced metering infrastructure (AMI). AMI plays a key role in smart grid technology, and many utilities begin smart grid implementation with AMI. GIS is used to superimpose the complete electrical network assets from generation to service point on top of the land base data.

IV. CRITICAL ROLE OF GIS IN DISTRIBUTION SYSTEM.

GIS plays a strong role in the management of distribution system. GIS is a framework or platform that underpins an electric utility information technology system. GIS creates spatial information about utility assets (poles, wires, transformers, duct banks, customers) and serves that information to the utility. The combined data served from the GIS and scada is combined along

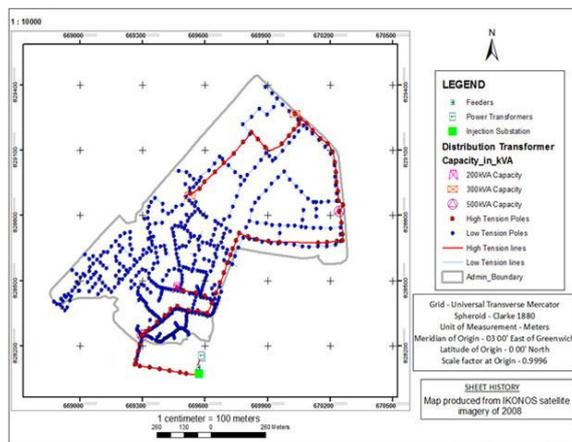
with other information from outside the utility such as traffic, weather systems, or satellite imagery. This combined information is used by utilities for visualizing a common operating picture to monitor and maintenance for network analysis and planning. Relationships between systems and the environment can be understood with the application of GIS; GIS can show the view of the grid and note the changes. [5]

GIS as compared with a SCADA system can show the complete state of the network represented by a realistic model. GIS and fault passage indicator (FPI) can be combined to identify the fault location easily and quickly.

GIS helps O&M to give the visibility and pattern of energy losses, making the remedial measures simpler. Model of a GIS is useful to visualize it as a set of map layers. GIS is useful for a well organization of information on a computer system linking the database to map. A GIS can update the information accurately. GIS can manage information of electricity to customers and information describing the attributes of each customer such as location and electricity consumption.

The automated mapping (AM), helps the utilities to quickly create digital maps of their supply area using the digitization facilities of the software. The maps when digitized contain detailed information about the site service by the utility, and its precised location and technical information of the distribution network equipment that are installed in the field.

For example, if an employee wants to know the date of installation of a given transformer. He will just have to click on that transformer symbol. The represented attributes of that transformer will show him the installation date and the information related to it. Assume that the same employee now further wants to know more complex information. If he only wants to see 100 KVA transformers on the map installed prior to a given date. The query facilities of the software will quickly process his requirement, and show on the map only those transformers of 100 KVA, hiding all other transformers. At another time if he wants to assess the requirement of a cable to be laid along a certain road, the GIS will return him the results of processing considering even all the bends and turns the road may have. The cable length so shown by the GIS will be precise and will therefore help him procure the exact required quantity of the cable.



Source: Field Work (2012)

Fig. IV.1

Electricity Distribution Network Map

V. Conclusion

GIS plays a significant role in establishing a communication between automation systems like SCADA, DMS, AMR and customer care and billing systems. This, in turn, is helping the company in its smart grid journey making the management smart. GIS is indeed a transformational technology. Finally, GIS is a wonderful tool to help in the deployment of the smart grid itself. Utilities can monitor construction progress, route crews in the most efficient way, and help with analysis for locating the best location for repeaters. [5]

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