Integration of Space Technology and Electronic Devices: Calculating Loss on Tansformers Located in Bhurgaon Village of Dehradun district by using Geospatial Technology

Divya Uniyal, M.M.Kimothi, V.K.Dhuandiyal

Abstract- The population of the Uttarakhand state is about 84.89 lakhs at present state has sufficient electricity to distribute among the existing population but in future scenario by seeing that population is increasing is an alarming rate and urban scrawl , this condition may not be possible. Use of modern technology is essential for the development in this sector. Remote sensing, Geographic Information System (GIS), Geographical Information System, or Geospatial Information System is an emerging tool in this new most important area. With the help of this technology different studies can be done like Load Flow Studies, Load Forecasting, Management Information System (MIS), Total energy accounting, Installation of capacitor banks & network reconfiguration and High Voltage Distribution System (HVDS) etc. In this direction, one case study has been conducted at USAC, Bhurgaon village region of Dehradun district of Uttarakhand state. The main objective of the study is to calculate Loss in different transformers located in study area.

High resolution satellite data has been taken and georeferenced it in appropriate scale. Building the database primarily involves conducting GPS survey of consumer households, connected electrical feeders, poles and distribution transformers. Different thematic layers has been developed such as settlement layer, road map, LU/LC (Land use and Land cover) map, DEM (Digital Elevation Model), Aspect map, Slope map, location map of poles connected to Transformer and position of Transformers etc. With the help of connected houses to the poles, Loss on transformer has been calculated and result shows that in which transformer loss is more it plays a key role in determining technical loss, planning and optimization of distribution system. With periodic updating and monitoring, GIS mapping of the Electrical Network and Consumer database helps in improved load management, loss reduction, better revenue realization, asset and work management and possibly better consumer relationship.

Index Terms- Power distribution system, Remote sensing, Geographic Information System (GIS), GPS & DGPS and Geospatial Information System etc

1 INTRODUCTION

The distribution system is a part of power systems which is dedicated to delivering electrical energy to the end user. Present reform focus of India is distribution sector as this sector immediately affects the consumers. Economic importance of distribution system is very high and the amount of investment involved dictates careful planning, design, construction and operation which assure growing demand for electricity in terms of growing rates and high load densities. Present distribution system in India is the weakest link when compared to generation or transmission. High technical losses in the system are primarily due to inadequate investments over the years for system improvement works, which has resulted in unplanned extensions of the distribution lines, overloading of the system elements like transformers and conductors, and lack of adequate reactive power support. The commercial losses are mainly due to low metering efficiency, power theft and pilferages.

Distribution is the most critical segment of the electricity business chain. The real challenge of reforms in the power sector lies in efficient management of the distribution sector.

Scarcity of available land in urban areas and ecological considerations can put the problem of optimal distribution planning beyond the resolving power of unaided human mind. Load magnitude and geographic location of distribution system should be determined such that distribution substation must be placed and sized in such a way as to serve the load at maximum cost effectiveness by minimizing feeder loss and construction costs. Distribution system contains much wider varieties of voltage levels, components, loads and interconnections than the generation and transmission systems.

In Uttarakhand state, different hydrological projects are there which are generating about 4613.23 Million Unit electricity which is more enough to distribute among the existing population, so state is exporting electricity to other states which is a main source of income to the government of the state. The population of the Uttarakhand state is about 84.89 lakhs at present state has sufficient electricity to distribute among the existing population but in future scenario by seeing that population is increasing is an alarming rate and urban scrawl , this condition may not be possible. Use of modern technology is

essential for the development in this sector. **Remote sensing, Geographic Information System (GIS)**, **Geographical Information System**, or **Geospatial Information System** is an emerging tool in this new most important area. With the help of this technology Load magnitude and geographic location of distribution system can be determined such that distribution substation must be placed and sized in such a way as to serve the load at maximum cost effectiveness by minimizing feeder loss and construction costs.

2 OBJECTIVES OF THE STUDY

The main objectives of the study are as follows:

1. To generate thematic layers:
   - Settlement layer generation
   - Road map generation
   - Located Transformer layer in study area
   - Located pole layer in study area attached to that particular transformer
2. To find relationship between poles and settlement layer.
3. To calculate Loss in different transformers located in study area.

3 STUDY AREA

The study area comprises with Bhurgaon village of Dehradun district of Uttarakhand state with latitude and longitude is 30.3157^0 and 78.3586^0.

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4 DATA USED

Satellite data: High resolution satellite data

Collateral data: GPS (Global Positioning System), DGPS (Differential Global Positioning System)

5 METHODOLOGY

The major steps involved in the methodology that has been formulated for remote sensing based study ***"loss on Transformers located in Bhurgaon region"*** are as follows:

5.1 Acquisition of satellite data

Table 1. Ground based information collected in the given format:

S. No.	Geog. Lat	Geog. Long	Ant no.	Type	In	Un
Fn (Frequency)	Qn.	Vi (Input voltage)	Temp cat.	IS	Lot No.	

Table 2. Ground based information collected in the given format:

S. No.	Geog. Lat	Geog. Long	Pole number	No. of houses attached to pole

5.2 Data processing

5.3 Geo-referencing of Data

5.4 Collection of Ground truth information

For Transformer:

For poles attached to transformer:

5.5 Analysis of satellite data and Thematic layer generation:

- Settlement layer generation
- Road map generation
- Located Transformer layer in study area
- Located pole layer in study area attached to that particular transformer

5.6 Finding the relationship between poles and settlement layer: To find the relationship between poles and connected houses to those poles which are connected at any particular transformer?

5.7 **Loss calculation in different transformers located in study area:** Loss at any transformer will be calculated on the basis that how many houses attached to one transformer and what is the capacity of that particular transformer or how much electric power people are utilizing.

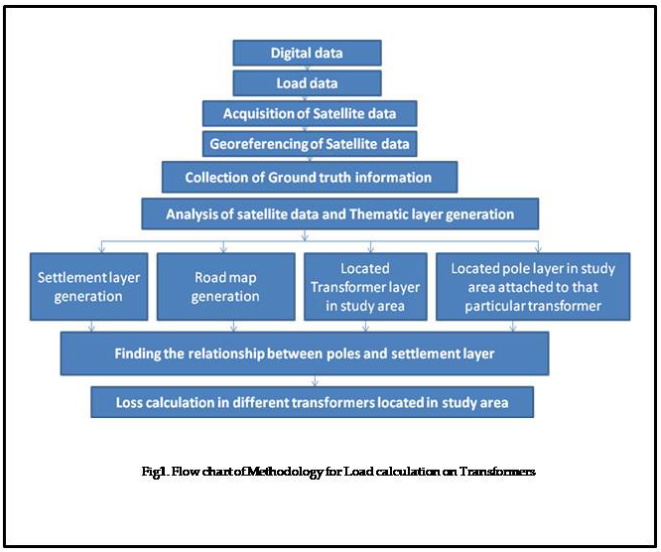

Fig1. Flow chart of Methodology for Load calculation on Transformers

Table 6: Tabular representation of total power required for 182 houses situated in the study area:

Total power required to single story building=1 k watt	Total power required to total 83 single story building=83 k watt
Total power required to double story building=2 k watt	Total power required to total 99 double story building=198 k watt
Total power required total 182 houses	281 k-watt

Table 4: Tabular representation of no. of houses connected to poles and no. of Single and double story buildings:

Transformer no.	Quantity	Total no. of settlement connected to transformer 3	Single story building	Double story building
Transformer 3	300 KVA	182	83	99

6 Result and Discussion

6.1 Tables

Table 3. Tabular representation of no. of houses connected to poles, Capacity and loss on Transformer:

Transformers	No. of houses connected to poles	Quantity	Supply of Electricity to each home	Loss on Transformer
Transformer 1	35	150 KVA	49 KVA	———
Transformer 2	05	——	——	———
Transformer 3	182	300 KVA	281 KVA	19 KVA

From above mentioned tabular representation of calculation, we can conclude that loss on Transformr 3 is app. 19k-watt.

- *Divya Uniyal, Uttarakhand Space Application Centre (USAC), Dehradun. PH-09997777129, E-mail: divya.uniyal@rediffmail.com*
- *M.M.Kimothi, Space Application Centre (SAC-ISRO), Ahmedabad*
- *V.K.Dhaundiyal, Uttarakhand Space Application Centre (USAC), Dehradun)*

Table 5. Tabular representation of no. of houses connected to poles and Supply of electricity:

Transformers	No. of poles	No. of houses connected to poles	Quantity	Supply of Electricity
Transformer 1	11	35	150 KVA	Inside Vasant vihar
Transformer 2	02	5	———	Outside study area
Transformer 3	81	182	300 KVA	Inside Vasant vihar

7 Conclusion

From this study undertaken, it can be concluded that the power Distribution Company and the department can be used in many ways to improve the planning, maintenance and management standards of the department. With periodic updating and monitoring, GIS mapping of the Electrical Network and Consumer database helps in improved load management, loss reduction, better revenue realization, asset and work management and possibly better consumer relationship.

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