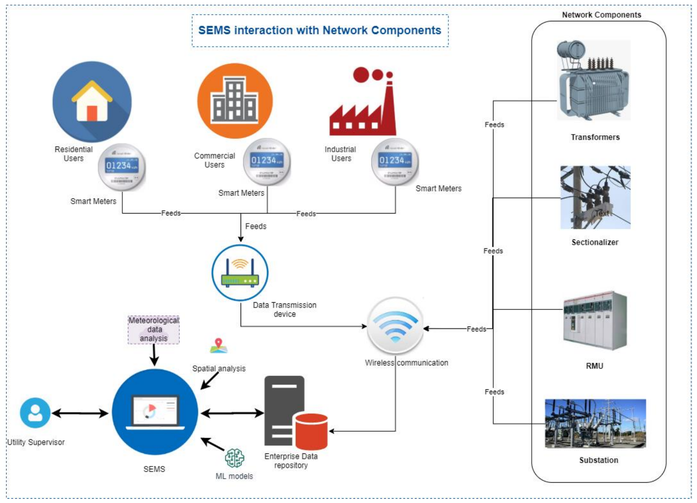
SPATIAL ENERGY MANAGEMENT SYSTEM FOR UTILITIES

Introduction

For Electric Utilities, it is always a challenge to identify the areas for load shedding when there is a shortage of power supply. This is a complex problem for the Utility planner mainly due to lack of demand forecasting tools. Forecasting demand in a particular area requires thorough understanding of spatial attributes such as population density, land use, climatic conditions, economical and cultural aspects. Also, heuristic power consumption information helps in improving the accuracy while forecasting usage consumption.

- GIS provides a platform to collect, store, manage, view and analyse spatial attributes whereas, Energy management system via smart meter roll out projects can provide usage consumption information.
- A Spatial Energy Management System (SEMS) is an integration of GIS and Energy Management system (EMS) that provides a set of powerful analysis tools that help Utility personnel in decision making to identify areas for load shedding during power supply shortage scenario. This will eventually result in increased utility revenue and improved customer satisfaction.

Conceptual framework for SEMS



In order to provide recommendations to users, SEMS run analytics using the following information:

i. Usage consumption data
ii. Spatial attributes
iii. ML prediction algorithms
iv. Meteorological data services.

Objective

The objective of the work is to develop SEMS comprising of powerful analysis tools for better and faster decision making for the Utility personnel. The system will use the following for forecasting the demand:

I. Spatial attributes such as population density, land use, climatic conditions, economical and cultural aspects
II. Heuristic information of feeds and events raised from various smart devices in the electric distribution network
III. Weather forecast and its effect on existing roof top solar panels
IV. Prediction algorithms of Machine Learning to improve accuracy.

SEMS will further analyse the forecasted demand and will provide recommendations to user highlighting the zones for load shedding. SEMS interface carries two primary components namely, spatial view and graphical view. Spatial view enables the user to perform spatial analysis on map viewer while the graphical view shows heuristic feeds as well as trends at smart meter or transformer level.

Study Area

Jeedimetla, Hyderabad has been considered as one of the region for Smart Grid Pilot project implementation in India. This area has been considered as study Area. This region is spread across 16 sq. kilometres. There are 5 substations, 43 feeders and 38000 consumers in this region.

For the study, data simulation is done for 4000 meter connections. The study area has good blend of land use and satellite imagery is used to classify the area as residential, industrial and commercial.

Topographical data from open street map source is used to inject population, economical and cultural attributes. Primary components of Electrical distribution network such as substation, feeders, transformers, poles and conductors is collected from state electricity board TSSPDCL.

Summary

SEMS provides a powerful interface in identifying the areas for load shedding when there is a shortage of power supply. This study demonstrates how SEMS can help the Utility personnel in making effective decisions to increase utility revenue and improved customer satisfaction. SEMS will become more significant when renewable energy from micro-generation is supplied to the grid. This work is in progress and is based on the conceptual framework.

Rama Rao Bandreddi and Dr. K.S. Rajan (2021) LSI, IIIT-Hyderabad