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Impact of Electric Vehicle Integration on Grid

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Abstract: *Load flow analysis is most essential and important approach to investigate problems in power system. It can provide balance steady state operation of power system without considering transients in it. This project presents a new and efficient method for solving the Load flow problem of a distribution network. By using Backward/Forward sweep method parameters like voltage profile, total power losses, load on each bus of the Distribution Network will be known. By using Load Flow load balancing of the Distribution system can be achieved. For load balancing we will use the power stored in the Electric vehicle. As Electric vehicle has large battery pack for storage. The impact of Electric Vehicle and load flow of distribution network is computer programed to implement the power flow solution scheme in MATLAB software.*

Keywords *- Backward/Forward Sweep, Distribution Network, Electric Vehicle, Load Balancing, Load Flow.*

I. INTRODUCTION

The traditional distribution system is considered the worst part. The distribution system begins with the installation in a distribution channel fed by one or more transmission lines. In some cases the distribution substation is fed directly from a high-voltage transmission line, in there is likely no sub transmission system [1]. This varies from company to company. Each distribution channel will run on one or more primary servers [2].
The distribution feeder loading is not measured naturally due to the large number of unbalanced single phase loads to be supplied. An additional inequalities are introduced by equal conductor spaces of three phase overhead segments and segments of the underground line. Due to the nature of the distribution system, standard power systems and short-term systems used for transmission system studies are inadequate [3-5]. Such systems show the divergence of the convergence of radial systems. Systems also use a fully integrated system to implement a single system for a single phase. If a distribution engineer is to be able to perform accurate power-flow and short-circuit studies, it is imperative that the distribution feeder be modelled as accurately as possible [6-9].
By load flow study of distribution network it will be very easy to design and predict the load demand and with the help of electric vehicle the load balancing of the distribution system can be achieved. By using charging and discharging of electric vehicle during the peak and non-peak hours a smooth load balancing can be achieved. With the help of load flow study a peak demand on any bus can be known.

II. LOAD FLOW STUDY

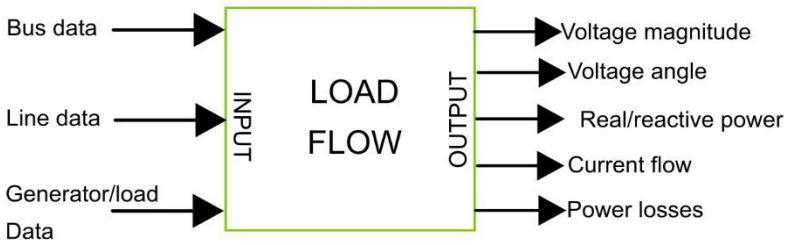

Figure. 1. Data Required for Load Flow

Load flow study is the consistent state investigation of power system network. Load flow study decides the working condition of the network for a given stacking .Load flow settles a bunch of synchronous non straight logarithmic force conditions for the two obscure factors (|V| and ∠δ) at every node in a network. To address non straight logarithmic conditions it is critical to have quick, effective and precise mathematical calculations. The reactive and real power, phase angle and voltage, slack bus power, and line losses are the output of the load flow analysis as shown in fig 1.

III. PROBLEM IN TRADITIONAL LOAD FLOW

The conventional load flow strategies are well maintain and proficient for transmission system. However, care should be taken in utilizing these techniques for distribution system, where a line R/X proportion is high and the system is normally worked in the outspread configuration. These attributes of distribution networks place them in the gathering of poorly adapted system nor reasonable for the traditional load flow strategies.

The Zbus or Ybus matrices of not well moulded networks don't display diagonal predominance (for corner to corner strength the slanting components of the framework ought to be prevailing which implies they ought to be far more noteworthy than different components). For badly adapted system the typical load flow strategies don't merge and subsequently we have separate distribution load flow methods to solve the issues.

IV. DESIGN METHODOLOGY

4.1 Backward/Forward sweep method:

The distribution system has a branched structure and high R/X values. So newton-raphson and fast decoupled methods have failed with the distribution system. The proposed method introduces a load flow study using a backward/forward sweep method, which is one of the most effective means of radiation flow system analysis. Using this method, the power loss of each bus branch and the magnitude of the power of each bus node are determined. This method on IEEE 33-bus radial distribution system the effective results will be obtained using MATLAB.

4.2 Propose Model:

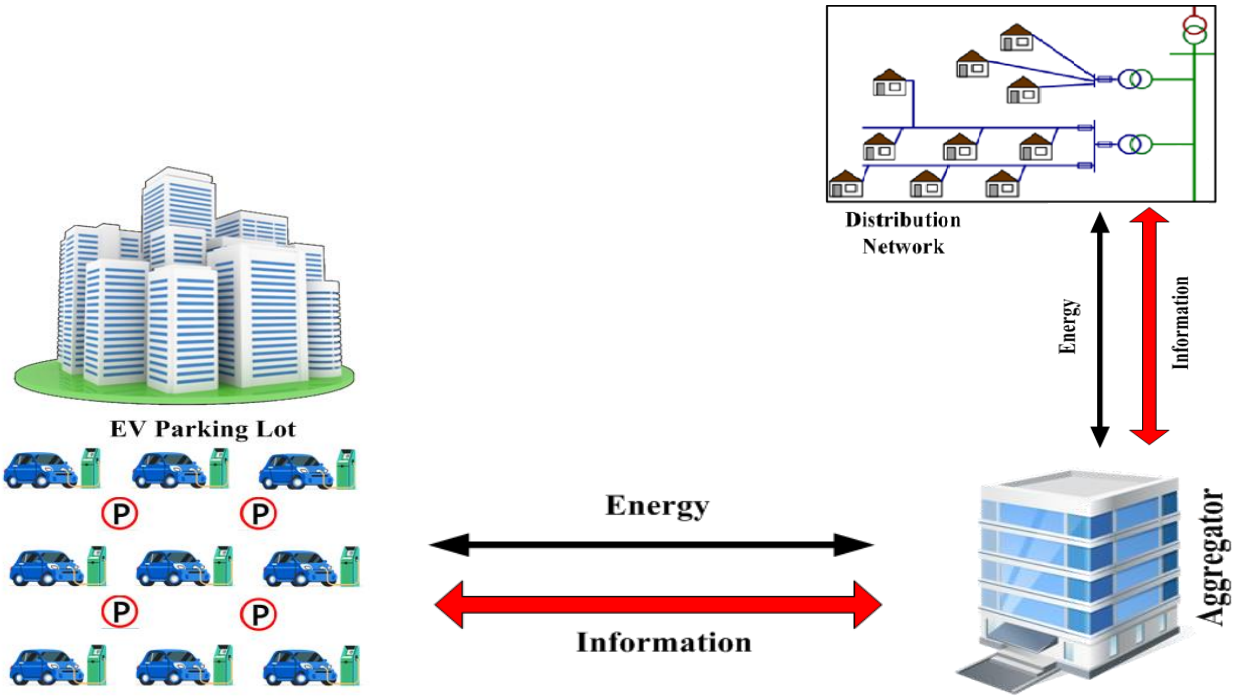

Figure 2: Propose Model for Energy Trading.

4.3 Working of Propose Model:

Let's consider distribution network as shown in fig 2. On the other hand there is Commercial building with specialized EV parking lot which might be possible in coming days. If there is a peak demand in distribution network then there is a requirement of additional it energy sources. In such cases EV being in parking lot, it can be assumed that from 9:00 am to 5:00 pm they are relatively fixed at same place. The energy stored, in battery with proper consideration can be used to supply such peak demand through aggregator. The role of the aggregator is to collect the information from DN & EV about the energy requirement & availability. This acting as the major player in facilitating energy trading process.

4.4 Algorithm:

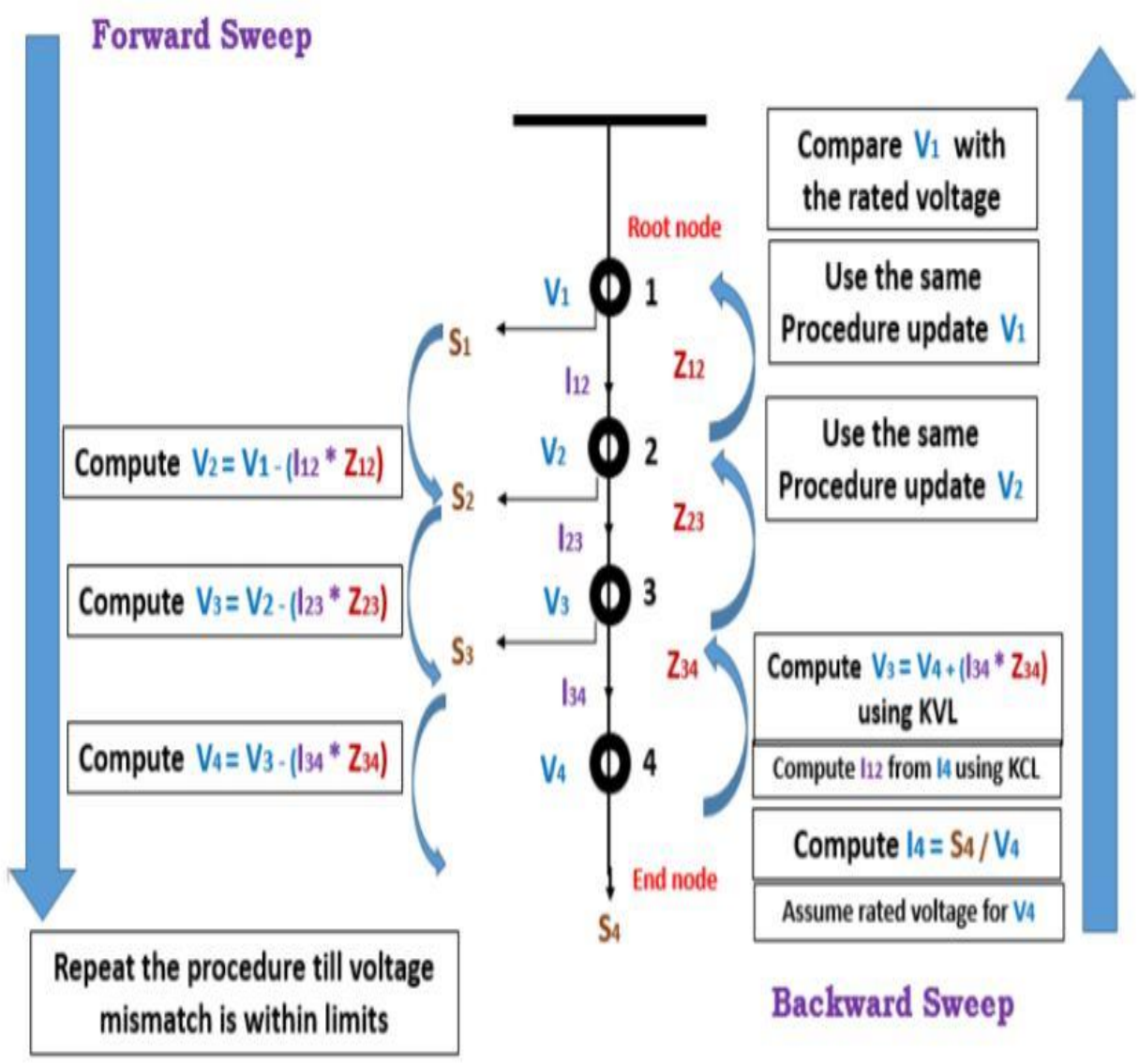

Figure 3: Algorithm for working of the Backward/Forward sweep method.

First Backward scope of the system is continued upstream beginning from end hub, continuing towards the source hub as shown in fig 3. End node voltage value is assumed and the corresponding nodal voltages are calculated from tail end of the feeder towards the source node by applying Kirchhoff's Voltage Law (KVL) and

Kirchhoff's Current Law (KCL). The determined voltage is contrasted and the source voltage and on the off chance that the union is inside cut-off points, at that point the interaction is halted else continued in the forward sweep downstream as shown in fig 3. In downstream the nodal current and voltage drop is determined from the source hub to the end hub utilizing KCL and KVL. Toward the end hub, the voltage is contrasted and the reference voltage if the intermingling is inside limits the primary emphasis stops, else the new voltage is refreshed toward the end hub and continued with in backward sweep and forward sweep till assembly is accomplished. In the backward sweep, the branch current from the last part to the substation end is determined. The branch current are determined and afterward utilizing condition maximum real and reactive power mismatch and voltage confound is taken as intermingling standards.

Flow Chart:

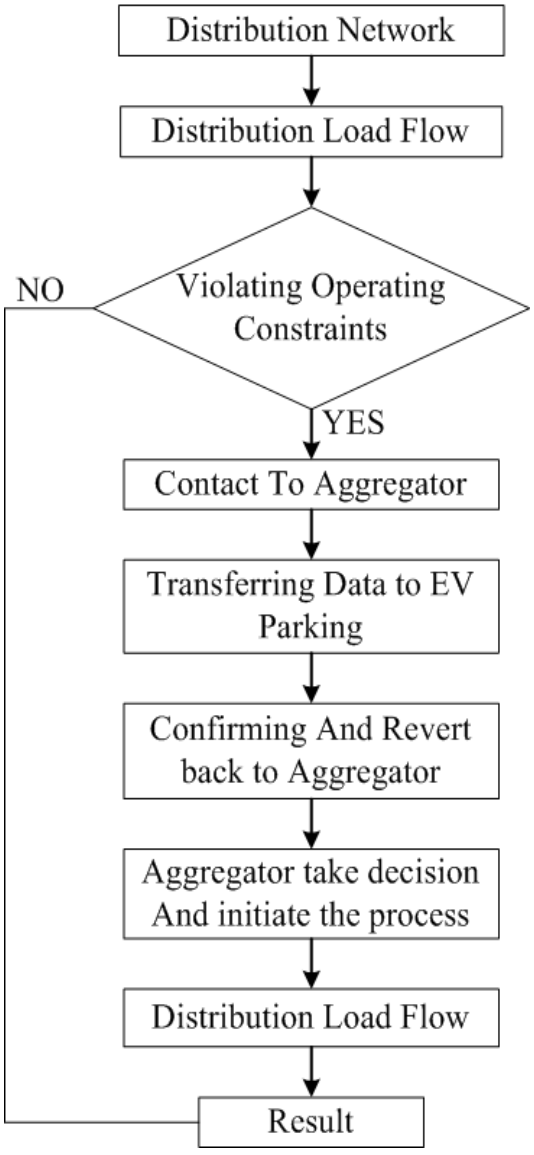

Figure 4: Flow Chart for the project program that will be used.

Let's consider the distribution network as shown in fig no. 1. Then we perform D.L.F.A on the Distribution network for assorted busses. We will monitor the per unit value of the D.L.F.A., then we inspect weather there are violating operating constants or not. If yes, then there is a special system design which consist aggregator which will process the information and transferred it to the EV parking lot. EV parking lot will confirm the data and transferred the data of available energy to the aggregator. Then the aggregator will take the decision and it

will initiate the process. After this again we will perform the D.L.F.A. on the distribution system. The outcome of D.L.F.A. will be our result as shown in fig. 4.

V. CONCLUSION

Using the proposed Load Flow algorithm, the maximum amount of savings can be obtained in number of steps taken, necessary to find the steady state load flow solutions. The time-saving required for the flow of downloads for all of these network topologies will be a major advantage. There is significant saving in no. of steps execution. An energy trading system will be proposed for energy trading between EV and Distribution Network. Load balancing of the grid network will be achieved and the losses during non-peak time will be reduced.

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