Smart Load Shedding

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Modern Power systems demand maintenance of essential security in the field of load shedding. We are still living in a society where a large number of houses go through long hours of power cuts in the locality. For many years, the increased effectiveness of the under-frequency load shedding (UFLS) schemes has proven to be a matter of research across the globe. Regrettably, the solution which was proposed mostly requires expensive technical resources and large amounts of real-time data monitoring. This paper presents a smart scheme for rapid and accurate load shedding using neural networks so that predicting the possible loss of load at the initial stage becomes feasible and neuro-fuzzy to determine how much load shed is to be done. The proposed techniques can provide tools for improving the reliability and continuity of the power supply. This was validated by the results obtained from various research papers reviewed in this paper. The authors aim to undermine an Under frequency Load Shedding Scheme characterized by increased effectiveness where the case is of large disturbances and foreshortened power which was disconnected in the case of small disturbances compared to the old conventional load-shedding methods. The aim is to provide centralized and distributed load shedding strategies.

Keywords: Power System, Load shedding, Fuzzy logic, Power Supply, load demand.

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1. Introduction

Load shedding, in general, is considered to be not so much desirable because it causes inconvenience to the customers. Also, the traditional methods were turning out to be too expensive to accept. Thus, the development of load shedding techniques based on frequency becomes very adaptive to easily predict the load and serve accuracy.

The most important parameters for the safety of the power system are voltage and frequency, therefore a continuous control of these parameters should be ensured to abstain the nation from the various disturbances in the electrical network causing blackouts. The expected advantages are achieved by replacing error-prone load dipping with the simultaneous load dropping techniques with inferred adaptive methods focused on fuzzy logic computations. In [1][2][3], the proposed algorithm does not demand any complexity and huge investment in its technical solutions.

Availability usually takes fixed steps to keep the system stable to avoid load shedding. If somehow substations face unexpected situations or faults, we have to opt for complete load shedding to prevent instability.Conventional load shedding is the way of sharing the available electricity among all its consumers, at the time of load shedding is necessary, the network is switched off according to a predetermined plan. Suddenly breakdown in the substation and improper switching of safety equipment in the substation would lead to a complete blackout. IoT can be used for better implementation of load shedding so that complete blackout will be avoided and consumers can do their basic needs.

The major factors upon which the accuracy of load shedding depends are explained in [4][5][6], the estimation of the amount of load shed and its accurate disconnection. Power distribution Lines are conventionally run through several natural conditions, which results in the smooth flow of power across the distribution end, but this medium caused various faults. We can enable to connect every user to a central database at the utility, which gives continuous data on the status of the power line. It will be really helpful for the live detection of the location and position of the fault and it will also help in power loss estimation and understanding load patterns.

2. The Current scenario in Load Shedding

As proposed in [18][19], Load shedding methods in conventional under-frequency load shedding plans are specified irrespective of voltage stability criteria, as a result, they were unable to bring any desired output in the event of combinational possibilities. Under these conditions, the location and amount of load drops should be determined. For adaptive load shedding, new principles are explored. This method collects data instantly which can be used to formulate frequency and its rate of change. Dynamic loads are represented with a D-factor to determine both frequency and voltage. Another new adaptive technique utilizes the principle of adaptive timing setting triggered. Adaptive methods help to reduce the accurate amount of load shedding.

3. Various Methods for Effective Load Shedding

Power systems stability has always been the concern of every developing or developed country. When all the possible contamination and controls are implemented and still didn't get feasible results then, load shedding is the last resort to restore the system efficiency and minimize the loss of power [3].Load Shedding has now become a common procedure to deal with extreme situations that arise due to power deficiency and drop in power system frequency across the globe. Thus, various methods are proposed to determine an effective load shedding.

3.1 Distributed Interruptible Load Shedding (DILS)
In [8][9][10][11][12], a new load control strategy was proposed, to provide a guaranteed solution for the correct operation of the electrical system by increasing the number of participants. It is possible to separate a load of every user into interruptible and uninterruptible parts and to operate

on the interruptible part only. In case of overloading, load reduction is the only solution to let the network operator.

3.2 Optimization Technique

It is explained in [9][10][11], that voltage and frequency are considered two important parameters which affect the maintenance of the stability of the power system. The parameters on which the level of disturbances is estimated include the rate of change of frequency, the number of loads shed at each bus has been identified based on calculated voltage sensitivity. For load shedding to be effective it has to be simple, fast, and conclusive. Numerical simulations are required in this procedure to examine the optimization. Some proposed multi-objective functions in [11] are to minimize the cost of generation, maximize the reserved generation, maximize the preventive action for one or more transmission lines, etc. Optimization technique in a way is a process of developing a mathematical model, as proposed in [12], to serve the decision-making in the power system. In this, the model proposed ensured the supply of maximum demand by minimizing the system loss.

3.3. Fuzzy logic

It is proposed [13][14] that the Analytic Hierarchy Process algorithm (AHP) and fuzzy logic are used to determine the load in the system and in selecting the appropriate steps corresponding to the load. The AHP helps to predict the meterage of the load and prioritizes the load nodes of the system according to increasing priority, shedding will be done. The methods were proposed by the experiment of load shedding on the IEEE 37- bus system using several applications and software.

3.4. Internet of Things

In [17][18][20][21][22][23], the most prominent and rigorous issue of load shedding has been detected and implementation is tried because after knowing the drawbacks of load shedding, we still have to shed the load, then we should use any hardware to detect the fault location as soon as possible and sort the fault from the system.A new method is initiated that has a hardware section implemented on the user module which is connected to a centralized system that alerts the administration just after the fault appears and notify the fault area, this hardware and notification help to sort the fault from the system and reduces the time and usual requirements of load shedding. Hardware also helps in the promotion of the user to reduce energy consumption.

Programmable load shedding [24] is a well-founded source that takes over the manual switching of switches concerning time. A real-time clock is interfaced with an 8051 Microcontroller by using GSM (Global System for Mobile Communications). The microcontroller gives the command to relay when set time with real-time. One command to switch ON and the other to switch OFF, a prominent feature of this project was multiple times ON/OFF entry.

3.4.1 SMART DIRECT LOAD CONTROL(S-DLC)

In [25][26][27][28][29] an unconventional algorithm to reduce the peak-to-average voltage and sudden blackouts was proposed. The technique utilized for optimization and real-time load control is the demand response. In this, the testing of the algorithm is done by developing a simulation system that will take 100 random customers with their random appliances.

4. Conclusion

After reviewing several articles, we fall to the conclusion that load shedding is an unhealthy technique but it is still implemented to supply the peak load demand across the region. Various load shedding techniques are already tested and implemented somewhere around the world. Every Power Station is working with the best possible techniques within their feasible range. Fuzzy Logic [2], IoT [4], and other various techniques are prominent in the current scenario. As explained in [6], With the advancement in technology and upliftment in the standard of living the energy demand will keep on rising. Therefore, the chances of supply being unable to meet the demand will be prominent. The proposed paper can further be advanced with the technical advancements in the

network. The current overhead transmission lines [30][31] will be put back by underground lines in the coming future and the detection of a fault will become more accurate with the help of AI technology proposed in this paper. It is only focused on load and data monitoring of the power consumption. The upcoming future demands massive power generation, which brings a predicament to the system. AI and smart load shedding will be the only key to ensuring stability in the system.

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Ravi Kumar Jain, Vindhya Srivastava, Akanksha Yadav, Sachin Verma

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