

# Chapter 19

## Reliable Smart Grid Framework Designs Through Data Processing and Analysis Process



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### Introduction

The increasing rise in population and energy use in recent times has enabled changes in the power distribution situation, as well as an increase in energy demand [1–3]. That would be to say, the traditional grid's technology faces several issues. Thankfully, the growth of pervasive computing and mobile internet systems has led to the emergence of a new power distribution architecture known as an advanced grid. Power systems could effectively increase power providing and improving while also addressing current challenges produced by conventional grids [4]. Smart grids could also provide outstanding service and provide connectivity to many sources of power generating [5]. As a result, the smart grid's capacity to self-heal and withstand attacks is critical in promoting a smart grid. Smart grids use a unified two-way or multiple network system to transmit power information, which seems to have specific communication infrastructure needs [6]. However, the multiple communications impact is poor, with many potential flaws; big data method can significantly improve communication precision and effectiveness; therefore, big data technology should indeed be vigorously integrated into smart grid development, the building of a new switching devices telecommunications network, to fix the issues of communication in smart grid [7, 8].

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In the world of big data, data compression technologies are gaining a lot of traction. Depending on the enhanced faulty processing signals, a real-time data reduction and rebuilding technique has been developed [9]. To achieve data compression techniques in energy systems, they used linear integers communication [10].

For smart grid information, a regular 2-D lifting wavelet reduction method is used. The steady flow constants of the power distribution compression algorithms technique [11] are derived from studies. Furthermore, this technique could effectively increase the quality of wireless technology, network connectivity, including storage capacity for determining insulating sub discharges, power dissipation, with a fast sample rate.

In the world of big data, compression algorithms software is gaining a lot of traction. Depending on the enhanced faulty processing signal, a real-time data reduction and rebuilding method. To achieve data compression techniques in the electricity system, researchers used linear numerical communication. For smart grid information, a periodic 2-D lifting wavelet decompression method is used. The quasi-steady characteristics of the electric grid lossless encoding method [12] are based on this work. The technique can effectively enhance the quality of wireless transmission, communication bandwidth, and volume of data for determining insulating sub discharged power losses and fast sampling rate.

## Related Works

The employment of a significant range of smart equipment to connect the electrical method to improve knowledgeable, autonomous electricity supply functioning is referred to as smart grid knowledge. Sensors, judgment support systems, sophisticated industrial automation equipment, and inertial measurement units are all fully incorporated into numerous smart network technologies of the smart grid. The intelligence substation, intelligence content delivery system, intelligence scheduling technology, intelligent energy meter, and other components make up the core framework. This smart grid could lower electricity supply operating costs, increase electricity supply stiffness, minimize electricity supply losses, as well as ensure the power base load is economical, secure, and dependable operational. Its smart grid offers different electricity generating accessibility, which makes it easier to utilize renewed energy, and it has a self-healing capability and attacking tolerance, significantly lowering the rate of electric grid failures. Smart grids were originally introduced in 2005, and they have since become a standard for current electric grid development.

Humankind has reached the information age in the twenty-first decade, with information systems being incorporated into numerous disciplines as well as the volumes of information created in group interaction increasing. In the information era, the industrial base is increasingly giving way to the globalized world. In this context, whoever can have the data resources, the marketplace, as well as the benefit of the big data era has arrived, commercial factors, economic interests, and other sectors of all group interaction can no longer function without information.

## Proposed Framework

Those aforesaid characteristics and difficulties of smart grid plus big data technologies have inspired me. That part focuses on introducing a unique paradigm for large processing and analyzing in the context of smart grids. Our suggested structure for massive processing and analysis in smart grid is shown in Fig. 19.1. Having created the information collecting as well as storing modules to address the fact that smart grid information cannot be handled in real-time through the cloud service. Many front-end machines are specially installed across from access to data as well as information processing. These front-end systems are also in charge of collecting the warning signals or information that has been discovered. The obtained huge data from the smart grid would next be analyzed. That preprocessing effort includes wavelet transformation and cloud processing. The key concept here is that the SVD processes were hosted online. The coarser smart grid's enormous amount of data would be significantly lowered as well as managed due to the cloud's tremendous processing capabilities. The top layer is the responsibility of evaluating and extracting usable knowledge from the processed data, as well as offering more sophisticated solutions to customers or electrical firms. The abstracted intelligence community, for instance, is being used in generating controllers, energy selling mechanisms, electrical operational structures, situation surveillance cameras, including threat assessment structures.

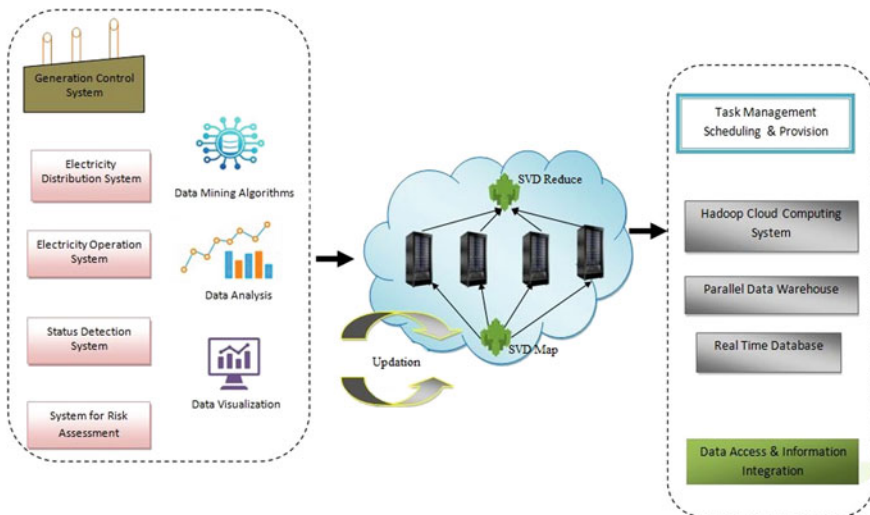


Fig. 19.1 Proposed architecture

## Observations

Researchers use load demand forecasting as a study case throughout this part to validate the practicality and efficacy of our suggested system. Because residential energy demand forecasts are a common need for the Power Network Organization, it may give information for decision-making for scheduled centers as well as provide effective power unit recommendations, thereby enhancing the program's safe and secure environment.

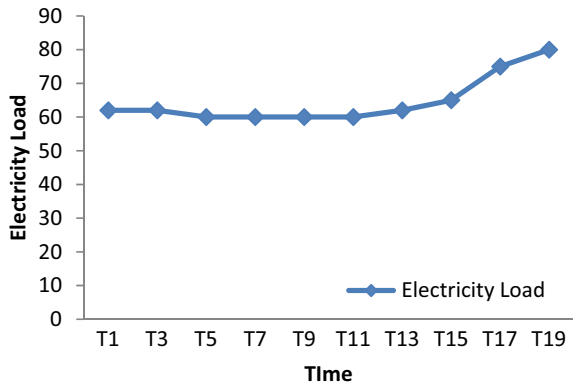
Researchers gathered information on energy load utilization for an anonymized consumer in Ahmedabad city (between 3 March as well as 24 March 2020) (see Table 19.1).

They began by collecting information on electrical load utilization for the prospective customer in Ahmedabad City using smart embedded sensors. Then, using our SVD technique, we remove the noise from the signal. As a result, data about routine electrical load utilization is screened out of the program. Afterward when, for projecting future electrical loads, the second exponential smoothing process is used. The projected energy load or pattern may be utilized to aid the electricity supply organization in making the best option for energy programming including choosing the best pricing approach. Using this method, designers could easily purchase the expected conclusions in our research study regarding the pattern of electrical load consumption with forecast outcomes. The segments lines that go within the rectangle in Fig. 19.2 represent the predicted power load in the next 3 time periods (It's worth noting that the time-stamping were set up as per user-defined criteria, including a 3-day delay among authentication information) (Fig. 19.3).

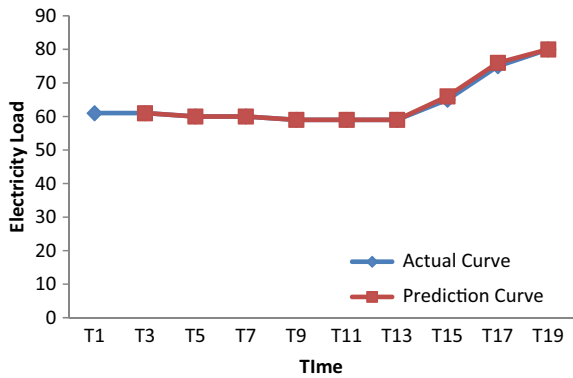
**Table 19.1** The electricity load usage

Time	Electricity load
T1	63
T2	63.5
T3	61.4
T4	60.1
T5	60.3
T6	60.9
T7	60.5
T8	61
T9	61
T10	60.7
T11	61.9
T12	63
T13	62.6
T14	65.5
T15	70.2

**Fig. 19.2** The trend of electricity load usage



**Fig. 19.3** The trend of electricity load usage and prediction



Experimental measurements, researchers may use the increased organizational to forecast the future power demand and to provide the best decision-making approach on both the firm and client ends (Table 19.2).

Because this user’s tendency is upward, experts might advise this user to moderate their electricity use in everyday life, as the pricing follows a step price strategy. In terms of balancing the demand as well as ensuring the stability of the system, the power network organization must reassess the programming of neighboring electrical load utilization patterns.

**Table 19.2** Result analysis

Time	T17	T18	T19
Electricity load	76.1	77.9	80.8

## Conclusions

That research proposed individual places for large processing and analyzing in smart grid, represent the current deficiencies of data transport, storing, and processing according to the properties of smart grid. Having designed an efficient data processing and reception architecture via network connectivity and incorporation, in particular. A prime example of user power demand predictions was undertaken with this proposed methodology to validate its practicality and efficacy.

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