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Green Communication for Power Distribution Smart Grid

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Abstract: ***Energy Optimisation is one of the prime need of modern era. The current traditional power distribution system cannot fully optimise energy and power usage hence leading to energy dissipation and wastage. The optimisation of energy can be very useful to prevent future extermination of the non-renewable resource that provides energy and power. For the current traditional power distribution system to become a power Optimisation system we will need to introduce the concept of an intelligent distribution system in to traditional power distribution system that is smart grids through green communication. The conversion of traditional power distribution system to smart grid system using green communication can optimise maximum energy and power thus providing controlled to end user.***

Keywords- *Advanced Metering Infrastructure (AMI), Advanced, Green Communication Architecture, Smart Grid (SG).*

I. INTRODUCTION

In this paper, the focus is to implementing the idea of applying the next generation wireless technology, a cognitive radio network, for the smart grid application. The system architecture, algorithms are developed using NI Lab VIEW. The implementation of such high level technologies is very complex thus formation of green communication in power distribution system using smart grid is highly complex. For the green communication part we will need to implement the concept of cognitive radio. A cognitive radio can sense a spectrum, which is available and easy to use for communication between two terminals and accordingly share the spectrum. To communicate we are using cognitive radio therefore converting traditional power distribution system into intelligent distribution system we are using smart grid smart data network that define how self healing, automatic system generation, finding strings logic etc can be done without human interference. This means no human interface is needed the power distribution system is fully automatic and operational this provides various advantages but the two major advantages are provide control to the end user and provide energy optimization for the full power grid system

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II. SYSTEM ARCHITECTURE

A. Generation Module

This VI deals with various processes which help in the proper functioning of the generation blocks.

The various processes are:

1. Bulk generation
2. Figuring out nearest value of power for transmission to the user
3. Saving extra power in for of battery/cell
4. Sending the power to transmission unit (with Sync and Ack configuration)
5. Saving details of power generation in to sever file

We will discuss this processor in detail one by one. But before that let's see what is actually Generation block function is

In layman terms Generation block is responsible for generating power for the user. Generation block contains all the sources of power generation such as hydro power generation, thermal power generation, wind power generation etc. cumulative of all the generation block is considered. It is assumed that the all the generated power is collected in a central grid. Now the problem is that the generation block is directly linked with user hence the power produced can't be always exactly precise, thus some extra units are generated. If these extra unit gets wasted it will defeat the purpose of getting green communication that means hundred percent usage of power without getting any power wasted, thus this extra power has to be saved in order to make this whole arrangement of power grid to be green communication.

The generation block is also needed comprehend what would be the nearest possible value of power that will provide the user the amount of power asked and get minimum extra power for saving. This means let's say if the user asks for 95 units of power then the nearest possible value for the generation block will be 100 units, thus 95 minutes would be provided to the user and 5 units should be saved as a battery. This is due to the problem that the generation block can only generate power in the multiple of hundreds.

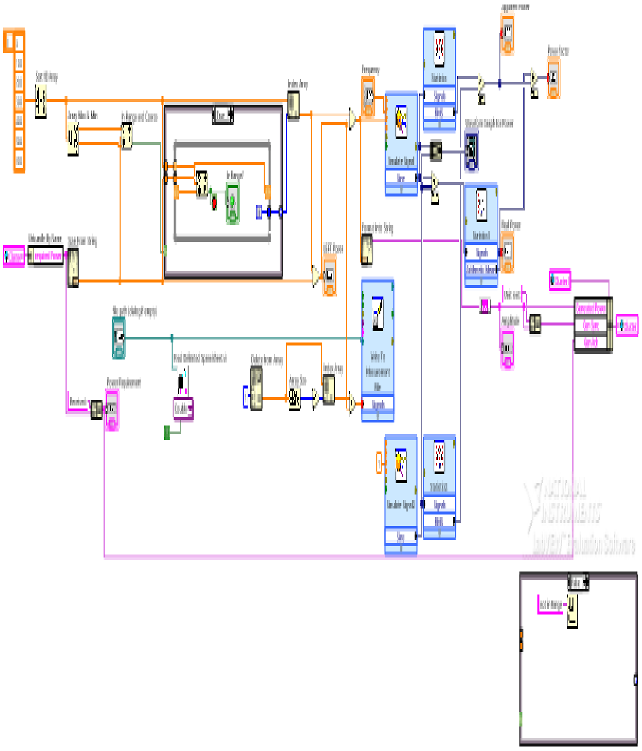

Figure 1: Electricity Generation unit

B. Transmission Module

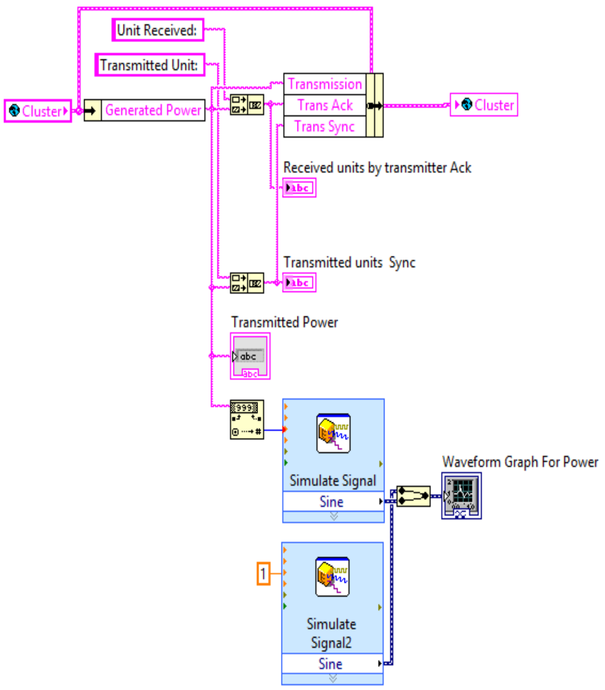

Figure 2: Transmission Module

This block deals with the power transmission from the generation module to the distribution module. The actual power transmitted from the generation module in form of a cluster is being transferred or transmitted to power distribution system.

Power transmission from the transmission module is done directly from cluster thus no distortions or power dissipation is being carried forward as this is a purely virtual and ideal system.

But in the future then real time application of this project would be processed than at that time there would be quite a number of power distribution due to which power dissipation would be there due to resistance electric electromagnetic flux etc So, in that case, storage unit will provide necessary power that is dissipated during the transmission.

The transmission module just does not transfer power from the generation module to the power distribution module it also does 2-way handshake from both generation module and the power distribution module.

The Two-way Handshake

We all have heard about the three-way handshake that is done to establish a connection that is the sender sends a synchronization signal to the receiver and then the receiver sends an acknowledgement signal to the sender. Now finally the sender sends an acknowledgement signal for acknowledging that he has received his acknowledgement signal.

In 2-way handshake, the receiver and sender send each other synchronization and acknowledgement signal for transmitted and received power. That is the sender sends the receiver synchronization or a power send a message and the receiver send the sender acknowledgement signal or Power received a message.

These synchronization and acknowledgement messages directly forward to the end user that is a house or a company. This house or a company is the ones which have provided generation unit with the required power usage. Hence in this smart grid system the user is the main head and can opt for any kind of path for power and amount of power.

C. Distribution Module

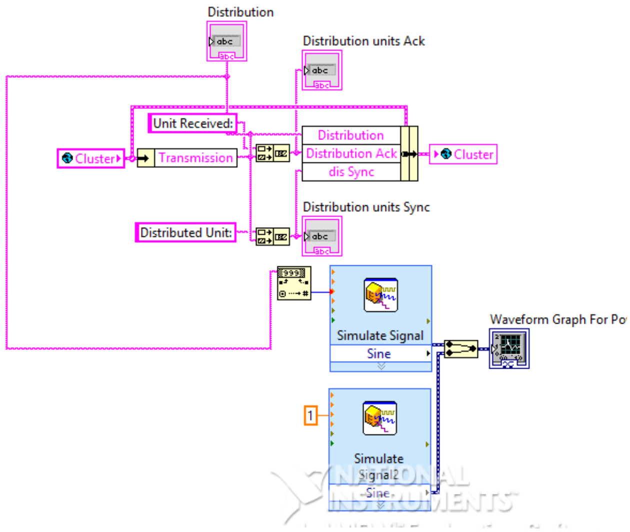

Figure 3: Distribution Module

The power distribution system is indirectly and directly connected with the number of household blocks that need power.

The distribution unit is not only functional for power distribution but it also keeps the measure of the amount of power of particular area is consuming.

Let's say if an area is consuming an unnecessary amount of power then the power distribution module checks for some error if there are any assuming uncharted power Surge, is caused due to shorting of some Transformers.

The power distribution system checks for some random error that can cause such effects so as to avoid such mishaps.

The power distribution system also needs to transfer the acknowledgment and synchronization signals to the user and transmission block module. These messages carry the information of transmitted and distribute power and can help in understanding if there is any power dissipation in between.

Thus distribution block help in providing in communication for power distribution system using smart wait.

D. Server

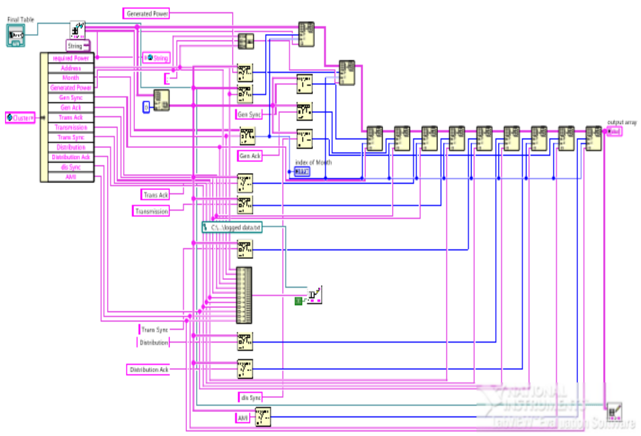

Figure 4: Control Unit

The main server deals over with all the information from various blocks such as generation block, transmission block, distribution block etc. It gathers and stores information of synchronization and acknowledgment power transmission and power distribution, of the person and place from where the power requirement has been generated, the month and the time for which the power requirement has been generated.

It also stores auto metric infrastructure unit that deals with the amount of money to be paid for the power generated by the generation module. Firstly the main server quantifies the data received through the cluster, using a bundler it bundles the information given by the cluster the cluster.

The cluster then provides the server with information such as required power, generated power, transmitted power, distributed power, synchronization and acknowledgment of all the above powers, AMI.

The house number or the address from the requirement and the month makes a 2-D grid, search as a 2D array. Using month as a row and column as a house number the details of different activities is being entered by the server and stores it as a file.

It is the responsibility of a server to connect the user no Internet connection and provide it with different details of the power that is to be generated does provide the control at the user end. But at once only one kind of details can be shown at the time so the server to another excel file in form of text in which details of previous power used and the consumer is been stored.

E. Cluster and AMI

i) Cluster

The cluster is the formation of a group of different data types such as numeric, text, string, array etc. It is been combined into a single group or structure which is known as a cluster.

In LabVIEW, the cluster can be either local variable and global variable. If you want to use the cluster in a single program that is in a single VI then the cluster can be local variable does you can change the cluster simultaneously with the program in the same VI.

But if you want to use a global cluster then there would be a VI which would be created by another VI in which the Global variable function would be declared.

This Global VI can be accessed by any functional VI which is there on the computer at that time. This acts as a trans-receiver which transmits as well as receive data from date different input the input generation module, transmission module, distribution system module, automatic infrastructure module etc.

ii) Automatic Metering Infrastructure

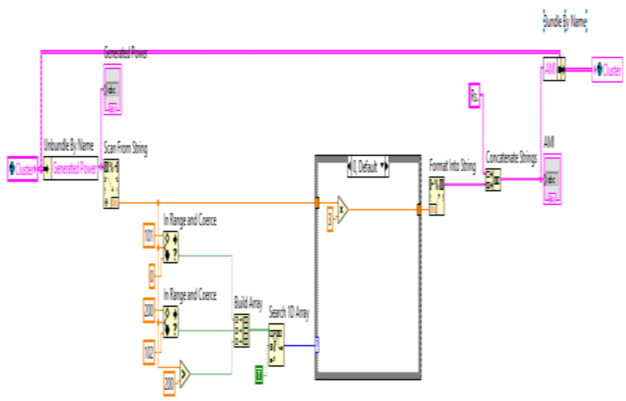

Figure 5: Automatic Metering Interface (AMI)

In automatic metering infrastructure, the concept is very simple it is used with the generation of billing of power generated.

As the name suggests the metering of power is done automatically by logics used by a computer.

Let's take an example to understand this, let's say amount of units consumed by a consumer 150 units, for the first 100 units the user will pay 3 rupees per unit and for the next 50 unit the user has to pay 5 rupees per unit, thus the total bill of this user would be 3 x 100 = 300 + 5 x 50 = 250, does the total bill equals to 300 + 250 = 550.

Perform this operation the multiplications, additions, and subtractions are used according to logic. This logic defines the billing system if there is an error in the logic the error would be shown in the bill. Hence correction of logic is must in this module.

III. PROCESSES

A. Bulk Generation

In which module of generation the amount of power required for specific month by the user is entered in the cluster. This data which is entered then goes to bulk generation module, the bulb generation module then decides what would be the most possible nearest value in multiple of hundreds. The energy is generated from numerous power sources such as renewable resources and nonrenewable resources and the renewable resources such as hydropower plant, solar energy, biogas plant, ocean Thermal Energy, geothermal energy etc, the non-renewable resources such as nuclear power plant, coal, petroleum etc. These sources provide apt power to generation unit so that it can provide the user with required power.

B. Figuring out the nearest possible value for power

It is the combination various circuitries such as for loop, addition, subtraction, multiplication etc. It helps in the processing of power from the generation module. This circuit plays an important role in figuring out the nearest possible value of power, if this circuit fails, the power generation unit cannot decide how much power to be processed, this could lead to access power generation, which will result in loss of excess power and thus resulting in making the power grid generation, not suitable for green communication.

This process also helps to find out what amount of extra power is being generated by the generation unit and it separates extra of power from the required power.

C. Saving Addition of Extra Power Generated by the Generation Unit inform of Batteries of a Cell.

This process is interdependent on the above process. The above process defines the amount of extra power generated by the generation unit during, required power generation. It also removes the extra generated power and stores the power in the storage unit. Now the storage unit stores the power in form of cells or battery which then can be used as a secondary source of power in time of adversity.

Currently in the generation V I , the storage unit is replaced by a text file which can store a number of extra power generated as data.

At the time of real-time analysis and run this text file will be replaced by a general storage unit from which the power can be used as a secondary source.

D. Send power to the Transmission Unit with Synchronization and Acknowledgement Configuration

In the generation unit when the power required power has been generated, and if any extra power that was previously generated has been saved in the storage unit, then the required power has to be transmitted to the transmission unit. The transmission unit is a structure to which would be required for the transmission of power to various distribution and then provide it to major Cities. The transmission unit act as a mediocre between the generation unit and the distribution unit. The only other work that transmission unit is processing is that it's providing synchronization and acknowledgement signal for generation unit and transmission unit.

E. Saving the Generation Data in Server Files

All the conversation between the user and generation unit, the generation unit and the transmission unit etc are needed to be sent to the user so that the using can be kept updated about the power that is going to reach him in what amount of time and what would be the price for the same power. Other than that the billing system needs to be updated and those payments and power consumption details and other synchronisation and acknowledgement signals messages need to be stored in main server file which can be accessed by the user or professional expert at any point in time.

F. Power received at Transmission Unit

The transmission unit receives power from generation unit it checks whether the receipt power is equivalent to required power if the required Power is equal to received power then the power is transmitted directly to the power distribution module. And if not then it asks the generation module to redirect the power from the storage unit.

G. Sent Power to Power Distribution with Synchronization and Acknowledgement Configuration

When the transmission unit has transferred the received power from the generation unit to power distribution unit, it also sends synchronized signal. This informs the power distribution unit whether it has received transmitted power. The power distribution unit in return generates an acknowledgement signal that informs the transmission units that the power has been received successfully.

H. Power received at Distribution Unit

The power received at distribution unit is directly forwarded to the user. All the synchronization and acknowledgement signals are also received by the user. Thus, it gives complete authentication and power of controlling energy to the end user. Incase, power is not completely received by the user, it generates a fault which informs the power distribution unit and the server to receive required power from the generation unit again.

I. AMI and Cluster

As the required power is received by the user, the Auto Metering Infrastructure generates a bill for that required power by using generic logics that are provided by the server. The billing amount, month, area, address and other necessary details are saved in the cluster. The cluster then forwards these details to the server which can be seen as required by these users.

IV. FUTURE SCOPE

This type of smart grid system will be very helpful in power optimization and green communication over cognitive radio. The project will be helpful in various other sectors such as traditional power distribution systems, improving communication system, making the end user the main controller of the framework, creating more jobs for engineers in Electronics and Telecommunication, Computer, IT and various other disciples of engineering. It will completely remove the manual work done by people and replace by automatic services. This will also reduce the amount of energy dissipation or loss during transmission of electricity from one place to another. The storage of electricity which will be much simpler in form of cells which can be used as required. Thus, implementing this technology will have a lot of future scope in power electronics and systems.

V. CONCLUSION

Green communication for power distribution system: Smart grid is an excellent example how to eradicate unnecessary power dissipation. This system also has been understanding implementation of the advanced concept of cognitive radio system and smart grid system.

Using smart grid and cognitive radio systems and enhance intelligent system has been formed which would result in fully automatic electric generation bill and the online submission of such bills. Thus the end user of will decide from where the power has to be directed what type of power used to be used such as geothermal, ocean, biogas, nuclear, hydro etc. The end user also gets to decide from where the power has been directed let's say from distributor 1 or some other distributor and it also decide amount of power that would be provided to the end user. At last we conclude that this type of power Optimizations would you most preferred and its use for future uses and generation of various jobs providing minimum energy dissipation or wastage and provide the control to the end user.

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