Load Distribution by Micro Grid using Virtual instrumentation

R.Hariharan
Saveetha School of Engineering, India
harinov22@gmail.com

Dr.P.Usha Rani
R.M.D Engineering College, India
pusharani71@yahoo.com

Abstract — Power management is a major role in the power system. Power system must be distributing the power at reliable manner. This paper proposes as micro grid control design in power management using virtual instrumentation which helps desired real power and reactive flow between the utility grid and micro grid. The system can run in three different modes depending on power requirement in the micro grid. VI (virtual instrumentation) System can change the mode depend upon local DG source and load demand. When Local DG source meets the load demand the system operated by island mode. When local DG source lesser than load demand as micro grid gets the power from utility grid to meet the demand i.e. grid connected mode and when local DG source greater than load demand as micro grid sold the power to utility grid i.e. gain mode. This VI model is very reliable and flexible one to control the power sharing. It is real time control model while interfacing data acquisition device. The model of micro grid control design is simulated by LabVIEW.

Index Terms — micro grid, smart meter, distribution generator, gain mode, island mode, grid connected mode

1. Introduction

Micro grid is small scale power supply network. That is designed to provide power for a small consumer load. It enables local power generation for local load. Micro grid is a supervisory control unit, it comprises of various small power generating sources and the utility grid that makes it highly flexible and efficient. If the consumer load depends local DG sources and the utility grid thus preventing power outages. When small generating source greater than the load demand, that power can be sold to the utility grid. Micro grid consists of major components are distributed generation, loads, immediate storage, controller, point of common coupling. Advantages micro grid could be the answer to our energy crisis, transmission losses and power outages. So this paper proposes as micro grid control design in power management using virtual instrumentation. It is operated by VI program flow. This model is simulated by laboratory virtual instrumentation engineering workbench. It is Personal computer based virtualinstrumentation is a dynamic and attractive system. It is differ from the classical instrument. Its main advantages are flexibility and adaptability, low cost, wide development of extension PC boards with measurements features, attractive representation of measurement results, in different forms, on the PC's monitor. Virtual Instrumentation model is used to control the micro grid. It makes microgrid is more efficient and cost effective.

2. Problem statement

Currently we have energy crisis in our nation due to the lagging of resources. Power generating plant placed far away from the consumer's. The power transferred by overhead line so it produce line drop due to the transmission losses. It affects the power quality. Conventional energy resources it produces CO2 emission it affect our environment. These problems can regulate by micro grid. But micro grid needs fast response control device which facilitates desired real power and reactive flow between the utility grid and micro grid. So these problem is regulate by this VI model.

3. Related work

Above mentioned problems are solved by micro grid. In the micro grid not only consume power from the main source and also it consume the power from local non-conventional DG source like wind, solar etc. this proposed paper micro grid control design in power management using virtual instrumentation.. It monitor the data using data acquisition device it send to the VI model, then VI model is processed with respect to the load.

4. FLOW CHART

Program flow for micro grid control represent by flow chart. At first step small generating source like wind and solar power combined together and that power compare with the load demand. If both are equal mean the load does not consume power from the main grid.

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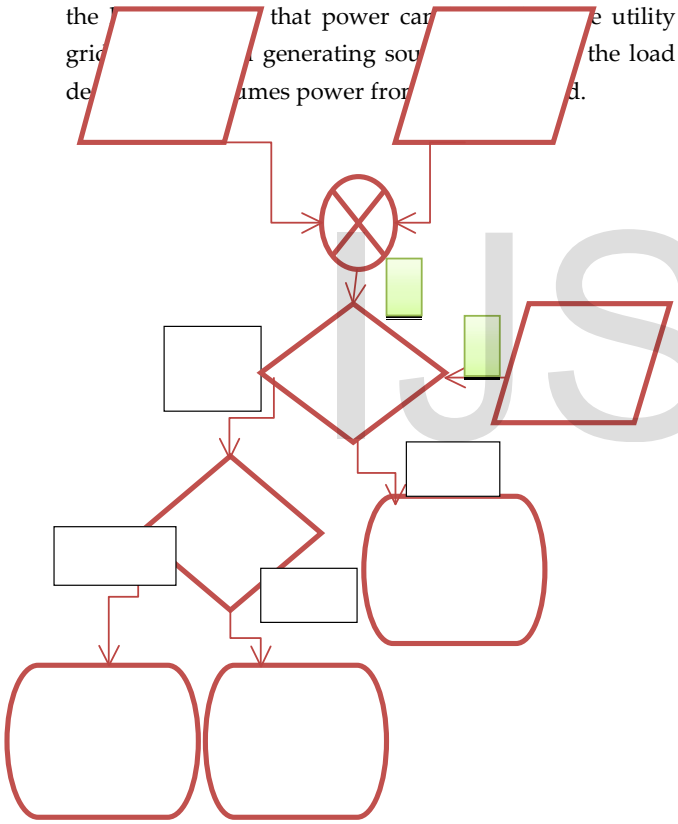

Figure1: Flow chart for Micro grid vi model

5. Front panel of Micro Grid VI model

Consider the three Bus systems to simulate the power management in distribution side using micro grid technique. Utility main grid generation power is divided by three branches like BUS1, BUS 2, BUS 3. BUS 1 source is connected with the ut load1 and also line is connected with the local DG sources like solar1, wind1. BUS3 source is also connected with the utility load3 with the local source like wind power 3 and solar power 3. And load 2 is depends only the main source, it's not depend upon the small generating source.

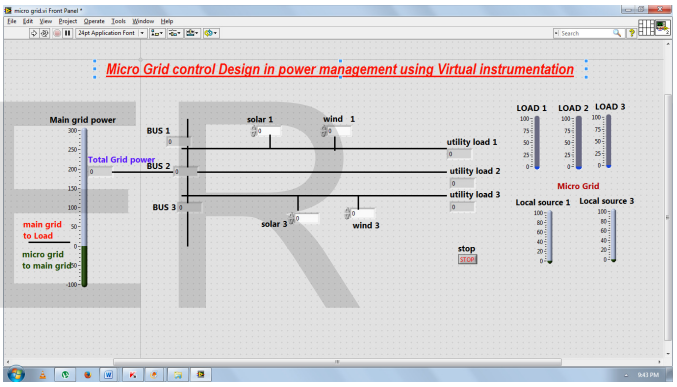

Figure 2: Front panel for micro grid VI model

6. Block diagram of Micro Grid VI model

Block diagram of micro grid VI model prepared by various tools usingLabview. Data acquisition device sense the data from Load demand, Local DG source and it is shown by indicator tool. The local DG sources (wind and solar) are combined together by addition mathematical tool and that total local DG power gets difference with the load demand. It decides the utility grid condition whether it is connected or not connected.

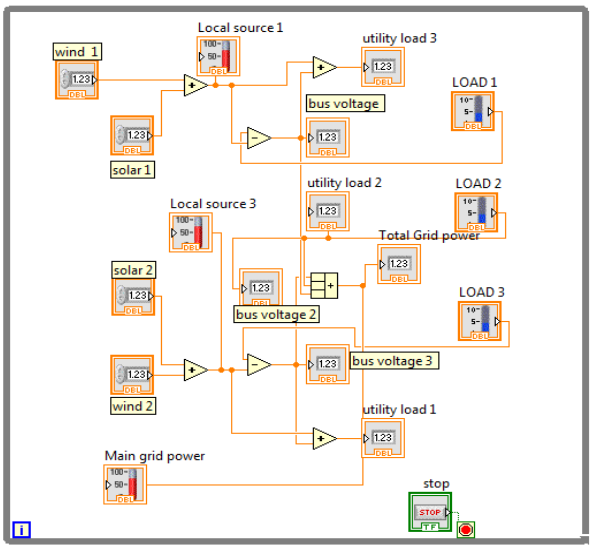

Figure 3: Block Diagram for micro grid VI model

Depend upon the result VI model act as three modes. Power management dependsupon the utility load and Local DG generating source. Local generating source enough to meet the demand means it never consume the power from the main grid. Local generating source greater than the demand it's sold the power to the utility grid. The block diagram consists of mathematical tool, indicator tool and controller tool with while loop. The block diagram are placed inside of the while loop for continuous operation.

7. System operation

a. Grid connected mode

Grid connected mode of the micro grid is load demand derive the power from only utility main grid. At this mode local DG sources are neglected means it's that power is zero. Simulation result for grid connected mode is shown in the figure. Total utility power is 300 W it is indicated by indicator tool. that power equally divided to three buses as 100w. so that local DG source like wind and solar shows 0W.so all the load deriving the power from only utility grid.

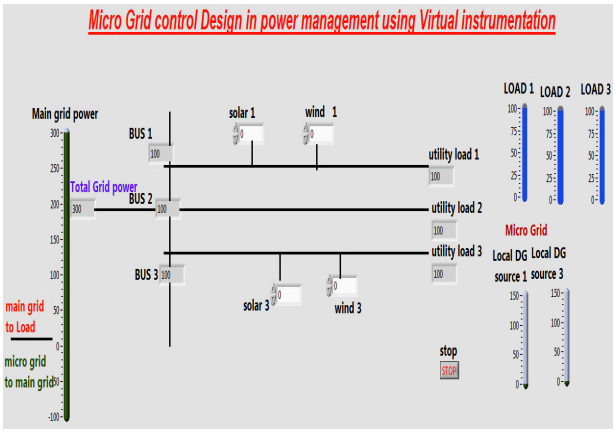

Figure 4 : simulation result for Grid connected mode

b. Island mode

Island mode of the micro grid is load demand derive the power from local DG source not utility main grid. At this Local DG sources meet the load demand, so the utility main grid power is isolated from the load. Simulation result for island mode is shown in the figure.Local DG source for line 1 is 150 W and local DG source for line 3 is 150 W. Total load for three loads is 300 w. so local DG distribute the power to the three load.

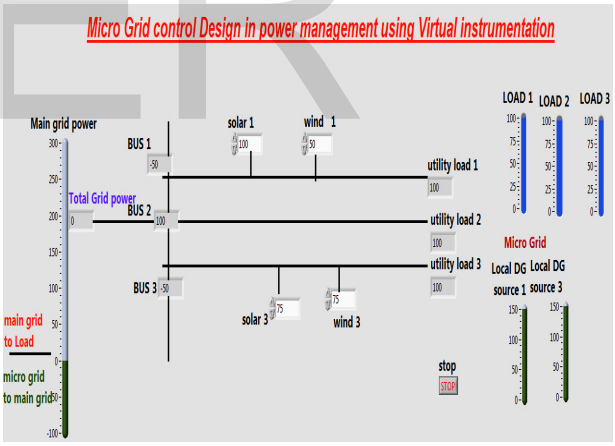

Figure 5: simulation result for micro grid VI model

c. Gain mode

Gain mode of the micro grid is excess Local DG source power is sold to the utility grid. At this local DG source total power is excess then the total load demand. So excess power is sold to the utility grid for distribute the power to other neighbor BUS. Simulation result for

Gain mode is shown in the figure. Local DG source for line 1 and line2 is 150W and the total load demand is 276.5 W is shown in the simulation by indicator tool. Excess amount of power is 23.5W sold to the utility grid, so it is indicated by negative symbol. Utility main grid power it shows - 26.5, negative represent sold power from load side to main grid.

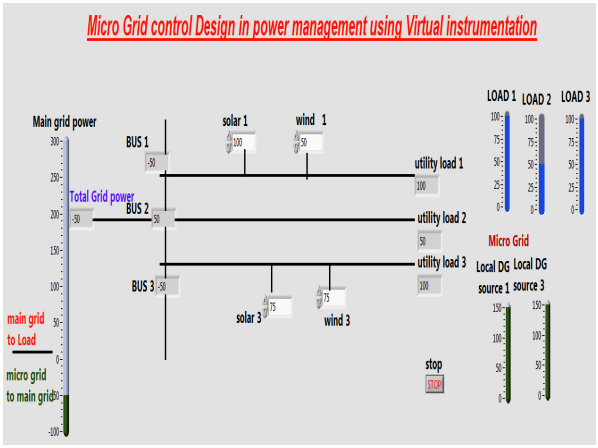

Figure 6 : simulation result for micro grid VI model

8. Formula for program flow

L1 = load 1, L2 = load 2, L3 = load 3

S1 = Local DG source, S2 = Local DG source, S3 = Local DG source

M = Utility grid power

M = (((L1-S1) + (L3-S3)) +L2)

If

[M = Zero (Island mode)

M = positive (Grid connected mode)

M = negative (Gain mode)]

9. Conclusion and Future scope

Due to improper power management it affects the power quality and provides power shortage to the distribution load. Micro grid provides solution for these problems. Load demand not only depend upon main grid power as well depend also Local DG Source. Depend upon the Local DG source and load demand micro grid operates as a three modes. As well micro grid controlled by VI model its fast data flow response system. This method is very cost effective and reliable. Future work of this paper implements with real system and analyses the performance of the system.

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BIOGRAPHY

R.HARIHARAN obtained BE degree from Arunai engineering college, Anna University, INDIA in 2009 and M.Tech degree from the Dr MGR Educational and Research institute University, INDIA in 2012. Since September 2012 he has been employed as an Assistant Professor with the Saveetha School of Engineering, Saveetha University, INDIA. His research interests lie in the areas of Embedded Systems, Controller Design, smart grid control and monitoring.

P. Usha Rani is Professor in Electrical and Electronics Engineering Department, R.M.D. Engineering College, Chennai, India. She received her B.E. degree in Electrical & Electronics Engineering from the Government College of Technology, Coimbatore, India, M.E. degree in Power Systems from College of Engineering, Anna University, Chennai, India and PhD in the area of Power Electronics and Drives from Anna University, Chennai, India. She has published over 29 technical papers in international and national journals / conferences proceedings (IEEE Xplore-5). She has 17 years of teaching experience. Her earlier industrial experience was with Chemin Controls, Pondicherry, India. Her research interests on application of Power Electronics to Power Quality problems and FACTS. She is life member of Indian Society for Technical education and member if IEEE.