International Journal of Engineering and Techniques (IJET)

Volume 7 Issue 3, May- June 2021

POWER GRID FAILURE DETECTION BASED ON VOLTAGE AND FREQUENCY VARIANCE DETECTION

Shweta Pawar[1], Jaiee patil[2], Krushita Ambhire[3], Jijesh Hambire[4]

PROJECT GUIDE: Prof. Jayshree H. Sali

Email: jayshree.sali@theemcoe.org

[1,2,3,4]Student, Department Of Electrical Engineering, Theem College Of Engineering, Boisar.

[1] Email: shwetapwr23@gmail.com, [2] Email: jaieep1999@gmail.com

[3] Email: krushita19@gmail.com, [4] Email: jhambhire8@gmail.com

Abstract*- *In present-day power system, electrical energy from the generating station is delivered to the supreme consumers through a huge network of transmission and distribution. There are many power generation units connected to the grid such as hydro, thermal, solar, wind, etc. to supply power to the load. Thus, for successful operation of loads, it is desirable that consumers are supplied with constant voltage and frequency. In this paper we present a system which can detect the synchronization failure of any external supply source to the power grid on sensing the abnormalities in frequency and voltage. For attainable transmission, the frequency and voltage of the AC supply should be within the limits as decided by the grid, depending upon the needs of the power supply. According to the CENTRAL ELECTRICTY AUTHORITY OF INDIA Regulations 2010, variation of the system voltage should be of +- 5 % and that for frequency close to 50 Hz and should not allow it to go beyond the range 49.2 to 50.3 Hz or a narrower frequency band specified in the Grid Code, except during the transient period following tripping. In case these limits are surpassed and the demand for power is more than the demand for supply, it results in grid failure. In such situations, the feeder unit is completely detached from the grid, causing islanding situation. Thus synchronization is needed between the grid and the feeder unit, so as to avoid the major scale brown out or black out of the grid power. In this paper, we are introducing a system which can notify the grid in advance so that alternate arrangements are kept on standby to avoid complete grid failure.

Keywords: Islanding, Grid, Microcontroller, Synchronization

I.INTRODUCTION

Energy provides the power to progress. Accessibility of enough energy and its proper use in the country can result in its people rising from existence level to highest standard of living. Energy exists in various forms in nature but the most crucial form is the electrical energy. The modern society is so much relied on the use of electrical energy that it has become a part and parcel of our life. Several new modes have already employed in the electricity infrastructure. It includes the growth of the existing grid with micro grids and mega grids, extensive sensors, data processing, visualization tools, etc. Increasing electrical energy demand, modern lifestyles and energy usage patterns have made the world fully dependent on power systems thus the need of a reliable and stable power system grid. However, the power system is a highly unpredictable system, which changes its operations continuously. Therefore, it is very demanding and inefficient to make the system be stable for all disturbances. At present, the curiosity toward the distributed generation systems, such as photovoltaic arrays and wind turbines, rises year after year. But wind turbines and generally DGs will have effects in the power system network that one of these factors is an islanding phenomenon. Islanding depicts to the state in which a distributed generator (DG) will

continue to power a system even though electrical grid power from the electric source is no longer present. Islanding situations can damage the grid itself or equipment's connected to the grid and can even compromise the security of the maintenance personnel that service the grid. According to IEEE1547 standard, islanding state should be encountered and disconnected in 2 seconds. This leads to concept of Automatic detection of Grid synchronization failure. Thus, the main consideration in our paper is to detect voltage and frequency failure in a grid.

II. LITERATURE VIEW

Rohan Solanki, Divyesh Patel, Yuvraj Gharia, Daivik Sailor, Bhumit Patel, AshishChaudhari[1],generated Detection And Protection of power grid synchronization failure system in which they gave the idea if any deviation From the acceptable range limit of the grid it is mandatory that some feeder should unfailingly get detached from the grid which in termed as islanding, these prevent in large scale brownout or blackout of the Grid power so it is recommended to have a system which can alert the grid in advance so that backup arrangements are kept on standby to avoid complete grid failure.

Karan Gupta, Shreyas Gupta, Kummad Verma, Anil Singh, Abhimanou Sharma[2], gave an idea of Detection Power Grid Synchronization Failure on Sensing Bad Voltage or Frequency Documentation in which they described in modern power system, electrical energy from the generating station is delivered to subsequent consumers through a large network of transmission and distribution. There are various power generation units connected to the grid such as hydro, thermal, solar, wind etc. to supply power to the load. Thus, for adequate operation of loads, it is acceptable that consumers are supplied with mainly constant voltage and frequency.

Shubhdeep Joshi, Tushar Parihar, Varun Kumar Shakya, Pradeep Kumar , Upendra Pal Singh[3] gave an idea of detection of power grid synchronization failure of sensing frequency and voltage beyond acceptable range in which they described that. The rules of grid involve sustaining a voltage variation within limits and also the frequency. If any deviation from the acceptable limit of the grid it is mandatory that the same feeder should automatically get disconnected. This avoids in large-scale brown out or black out of the grid power by sensing faults in voltage and frequency.

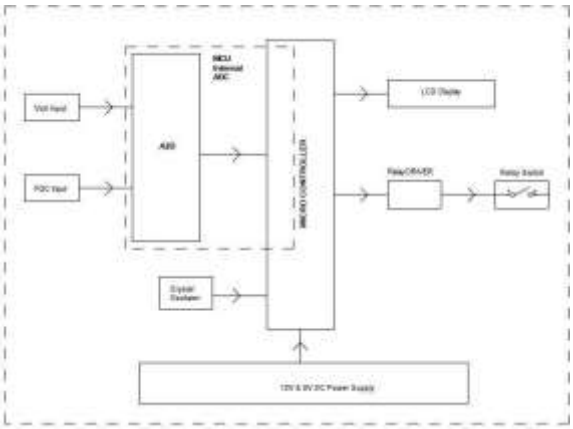
Laukik S. Raut, Shahrukh B. Pathan, Gaurav N. Pawar, Mandar V. Pathak [4], gave a concept of Detecting Power Grid Synchronization Failure on Sensing Frequency or Voltage beyond Acceptable Range. The system to verify the synchronization failure of any external supply source to the power grid on sensing the irregularities in frequency and voltage. There are many power generation units connected to the grid such as tidal, thermal, solar etc. to supply power to the load. These generating units need to supply power in accordance to the rules of the grid. These rules involves sustaining a voltage variation within limits and also the frequency. If any fault occurs then automatically the grid line should get disconnected. So it is preferable to have a system which can alert the grid in advance so that alternate arrangements are kept on standby to avoid complete grid failure. This system is formed on a microcontroller of 8051 family. The microcontroller observes the under/over voltage being derived from a set of comparators. As the frequency of the mains supply cannot be altered, so by using variable frequency generator (555-timer) frequency can be changed. A lamp load (indicating a predictable blackout, brownout) being driven from the microcontroller in case voltage/frequency going out of acceptable range.

III. METHODOLOGY

This system is form on a microcontroller of 8051 family. The microcontroller observes and checks the under/over voltage being derived from a set of comparators. As the frequency of the mains supply cannot be changed, the project uses a variable frequency generator (555-timer) for changing the

frequency, while a standard variances is used to change the input voltage to test the operation of the project. A lamp load (indicating a predictable blackout, brownout) is being driven from the microcontroller in Case of voltage/frequency going out of acceptable range. Further the project can be improved by using power electronic devices to isolate the grid from the faulty supply source by sensing cycle by cycle variation for more sophisticated means of detection [4]

If the voltage and frequency exceeds beyond the desired limits then it will affect the grid and causes grid failure. This feeder unit is completely isolated from grid causing islanding condition to maintain synchronization needed between the grid and feeder unit. [4-7]



(fig 1)

See the block diagram (fig 1) of the unit. It's based on a preprogrammed Arduino micro controller. The complete system divided in six sections. The finger print sensor interfacing, key board interface (input section), Relay and buzzer interface, and power supply section AC supply whose frequency is to measure connected with potential transformer. Potential transformer step down the AC voltage from 220V AC to 6V AC. Output of potential transformer is connected with bridge diode rectifier. Full bridge diode rectifier converts 6V AC into pulsating DC. Bridge rectifier is used to convert negative cycle of sine wave into positive cycle because microcontroller cannot read negative voltage.

After bridge diode rectifier, voltage divider is used to divide 6v pulsating dc into two equal parts because microcontroller cannot work on voltage more than 5 volt. Output of voltage divider is given to timer 1 pin of microcontroller. Timer 1 Microcontroller is used as a counter in this project which measures time between two consecutive zero crossings. Time measured by counter is divided by two since frequency of pulsating full bridge rectifier is double than sine wave frequency. All calculations are done in programming. After calculating frequency microcontroller displays measured frequency on LCD

IV. RESULTS

Voltage detection is by done by varying the potentiometer after reaching the acceptable range the LCD displays that the voltage exceeded 230V and the relay will be tripped and load of AC is protected. The frequency detection is done before the tripping of the light load the light flicker and frequency change will be displayed on the LCD. Hence a continuous monitoring load and faults in frequency and voltage is done by using microcontrollers. In this case the load variation will be detected. For changing the load in this prototype we are using LED's and lamp load.

V. CONCLUSION

This paper concludes that it is possible to have a power grid system that is smarter, more effective as well as efficient in its operation, thus proving to be more economical as compared to be the present installations. The challenge is a continuous and uninterrupted transmission which can be very well achieved with the implementation described by this project and in addition to the continuous transmission

several other parameters i.e. the passive parameters are being observed regularly and any issues occurring in these, are taken into consideration and accordingly worked upon, thus making the process of management and recovery easier and effective .This system is less expensive as compared to the other systems.

REFFERENCES

[1]. Rohan Solanki, Divyesh Patel, Yuvraj Gharia, Daivik Sailor, Bhumit Patel, Ashish Chaudhari, "Detection And Protection of power grid Synchronisation failure"- International Research Journal of Engineering and Technology, Volume 03, Issue: 05, May-2016

[2] Karan Gupta, Shreyas Gupta, Kummad Verma, Anil Singh, Abhimanou Sharma, "Detecting Power Grid Synchronization Failure on Sensing Bad Voltage or Frequency Documentation"-International Journal of Engineering Research and General Science, Volume 4, Issue 2, March- April, 2016

[3] Shubhdeep Joshi, Tushar Parihar, Varun Kumar Shakya, Pradeep Kumar , Upendra Pal Singh "Detection of Power Grid Synchronization Failure on Sensing Frequency and Voltage Beyond Acceptable Range"- International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, Vol. 6, Issue 4, April 2017

[4]. Laukik S. Raut, Shahrukh B. Pathan, Gaurav N. Pawar, Mandar V. Pathak, "Detecting Power Grid Synchronization Failure on Sensing Frequency or Voltage beyond Acceptable Range"- International Journal of Research in Advent Technology, Vol.4, No.4, April 2016

[5]. Assistant Prof. Karan Gupta, Shreyas Gupta, KummadVerma, Anil Singh, Abhimanou Sharma " Detecting Power Grid Synchronization Failure on Sensing Bad Voltage or Frequency Documentation"- International Journal of Engineering Research and General Science Volume 4, Issue 2, March- April, 2016

[6]. B.Naga Sarvani, B.Vineela Thulasi, K.Rahul , K.Satish Kumar, V.D.Sekhara Varma - "Detecting of power grid synchronization failure on sensing frequency and Voltage Beyond Acceptable Range and load protection"- International Research Journal of Engineering and Technology (IRJET),Volume 04 Issue: 07 | July -2017

[7]. Rohan Solanki, Divyesh Patel, Yuvraj Gharia, Daivik Sailor, Bhumit Patel, Ashish Chaudhari, "Detection And Protection of power grid Synchronisation failure"- International Research Journal of Engineering and Technology, Volume 03, Issue: 05, May-2016

[8]. Sarfaraz Ahmad,Dushyant Bagul, Rahul Harijan, Prof.Rahul Jadav, "Comparative Analysis of techniques for fault detection of Grid Synchronization" -International Research Journal of Engineering and Technology (IRJET),Volume 6, Issue: 1, March 2019