© 2018 IJSRST | Volume 4 | Issue 3 | Print ISSN : 2395-6011 | Online ISSN: 2395-602X

National Conference on Advances in Engineering and Applied Science (NCAEAS)
29th January 2018
Organized by : Anjuman College of Engineering and Technology (ACET) Nagpur, Maharashtra, India, In association with
International Journal of Scientific Research in Science and Technology

Power Grid Synchronization Failure Detection for Unacceptable Range of Voltage and Frequency

Shweta Bandre, Shubhangi Motghare, Swati Singanjude, Surya Wagh, Swati Dhote, Vaishanvi Ghugal, Prajakta Ashtankar

Department of Electrical Engineering, Smt. Rajshree Mulak C.O.E For Women, RTMNU, Nagpur, Maharashtra, India

ABSTRACT

The project is designed to develop a system to detect the synchronization failure of any external supply source to the power grid on sensing the abnormalities in frequency and voltage. There are several power generation units connected to the grid such as hydel, thermal, solar etc. to supply power to the load. These generating units need to supply power according to the rules of the grid. As per CENTRAL ELECTRICTY AUTHORITY OF INDIA REGULATIONS 2010, variation of the system voltage should be of ± 5 % and make all efforts to operate at a frequency close to 50 Hz and shall not allow it to go beyond the range 49.2 to 50.3 Hz. These rules involve maintaining 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 from the grid which by effect is termed as islanding. This prevents in large scale brown out or black out of the grid power. So it is preferable to have a system which can warn the grid in advance so that alternate arrangements are kept on standby to avoid complete grid failure. Further the project can be enhanced by using power electronic devices to isolate the grid from the erring supply source by sensing cycle by cycle deviation for more sophisticated means of detection.

Keywords: Synchronization, Islanding, Grid, Voltage variation, Frequency variation, Black out.

I. INTRODUCTION

In India we have five national grids, Western grid, Eastern grid, North-East grid, Southern grid, Northern grid. Northern grid, Eastern grid, North-East grid, Western grid are synchronized with each other and southern grid is asynchronized. The modern society is so much dependent upon the use of electrical energy that it has become a part and parcel of our life. Several new trends have already employed in the electricity infrastructure. It includes the expansion of the existing grid with micro grids and mega grids, extensive sensors, data processing, visualization tools, etc. For synchronization of all power generating station with State as well as National power grid we have selected three parameters voltage, frequency and phase angle between voltage and current if any of these parameters is violated due to any abnormality or fault the power station will not be able to fulfill all the three condition for synchronizations so it will get a synchronized with grid and its called

situation of ISLANDING. Islanding state occurs when one or many sources continue to feed power to a part of the grid that is disconnected from the main utility. Islanding situations can damage the grid itself or equipments connected to the grid and can even compromise the security of the maintenance personnel that service the grid.

1.1 CONCEPT OF GRID

An Electric grid is a network which can consume synchronize power from distributed generation unit and deliver or provide to the load that are connected by transmission and distribution line. Also it is network of cables or pipes for distributing high voltage power. Grid is a center of power transmission from that power is transmitted over all the area. In a synchronous grid all the generators are connected in parallel and run not only at same frequency but also at the same phase. Grid failure or power blackout is the total loss of power to an area. Blackout which result from or result in power station tripping are particularly difficult to recover quickly. Power outage or blackout may last from a few minute to a few week depending on the nature of blackout and configuration of electric network.

1.2 CONCEPT OF SYNCHRONIZATION

Synchronization is the process of the closing the circuit breaker after matching the generator frequency, phase angle and voltage magnitude with grid frequency, phase angle and voltage magnitude respectively. The synchronization is not done in ac generator unless it is running at same frequency as that frequency of grid and the dc generator have to adjust its open circuit terminal voltage to synchronize with grid voltage.

1.3 ISLANDING

Islanding is an unsafe condition which occur on grid, in which extra feeding of power is done to grid from distributed generator unit, even though the utility of power from grid is down. Also when the islanding occur on grid feeder is get open to secure the grid from the blackout or grid failure.

II. DETECTION OF POWER GRID FAILURE

The basic principle of this project is to detect the grid synchronization and sensing the voltage and frequency beyond range. The system is based on a microcontroller family. The microcontroller monitors the under/over voltage derived from a set of comparators and under/over frequency from by the interrupt program for the utility grid and the processed value of voltage and frequency for turning ON/OFF the relay between a grid connected inverter and the utility grid.

2.1 Block Diagram

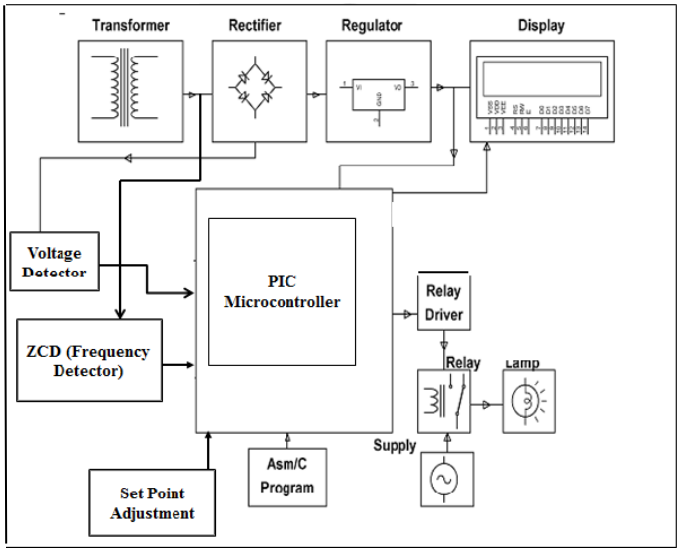

Figure 1. Block Diagram

2.2 COMPONENTS

HARDWARE REQUIREMENTS :

i) PIC Microcontroller
ii) LCD
iii)Resistors
iv) Capacitors
vii) Voltage Regulator
viii) Relay
ix) Relay Driver IC
x) Standard Variac

v) Diodes xi) Lamp
vi)Transformer xii) ZCD

SOFTWARE REQUIREMENTS:

i) MPLAB IDE compiler.
ii) Language: Embedded C or Assembly.

2.3 WORKING

The main purpose of this project is to detect the grid synchronization by sensing the voltage and frequency which are not in an acceptable range, and then stopping the power supply towards the distribution system i.e. the supply towards the feeders. In this project we used the grid synchronizing technique is zero crossing detection. In this system, the main supply is given to the transformer which is step down to 230V/12V then that 12V AC supply is given to the zero crossing detector through rectifier and the full wave rectifier is used for the rectification purpose. After rectification is done that dc is given to the capacitor which is used as filter. Then given to voltage regulator IC LM 7805 that convert supply into 5V, 1Amp. After this total process the 5V DC supply is given to the PIC microcontroller. The ZCD (zero crossing detector) used as a comparator for monitoring the under/over voltages and also monitor the natural frequency. A standard variac is used to vary the input voltage and a set point is there which is used to trip the relay for below or beyond the value of set voltage or frequency. The relay is controlled by the relay driver IC, which is connected to the microcontroller. The lamp is connected to the relay contacts for indicating the predictable blackout and brownout. The sensed parameters are send to microcontroller for calculations and processing.

For changing parameters we have to switch the sliding switch to manual position. By varying the POT (variable resistance) we can achieve the different voltage and frequency levels. LCD displays the corresponding frequency level and voltage level and lamp glows on abnormal conditions (undesirable conditions).

III. RESULT AND OBSERVATION

Table 1. Observation Table

Parameter / Limits	Voltage (volt)	Frequency (Hz)
Over Range	241.5	50.3
Set Range	230	50
Under Range	218.5	49.2

From the above observation table it is observed that the tolerance of voltage is ± 5 volt and frequency should not go beyond the range 49.2 to 50.3 Hz as per standard. Normally the range of the voltage and frequency is 230 volt and 50 Hz respectively according to Indian standard. In this paper according to the results we observed the following conditions.

WORKING CONDITION

In normal situation, the LED or lamp do not glow indicating 50Hz and stable voltage. In any deviation from voltage range or frequency range, the LED or lamp glow indicating failure of grid synchronization. This program is also written that in either of these cases whether the frequency is low / high (or) the voltage could be either in high / low condition , through the microcontroller they are all displayed in the LCD display and the output is connected to a relay to switch ON or OFF a load.

IV. CONCLUSION

This paper give brief idea about developing a system to detect the synchronization failure of any external supply source to the power grid on sensing the bad voltage and frequency. Number of distributed generator connected in parallel to the grid, to supply power to the load. Each generator having follow the rules of grid. These rules involve maintaining a voltage and frequency variation within limits. When any fault occur on grid and due to this grid broken a rules and deviation occur in voltage and frequency. When deviation occur in grid feeder is mandatory to open from grid and this process is term as islanding. This prevent grid failure or blackout.

V. REFERENCES

[1]. Suraj Wadhai, Madhuri Wadekar, Shreya Junankar, Chandrashekhar Rathod, Vaibhav Hingane, Ankit A. Zade. "Detection Of Power Grid Synchronization Failure By Sensing Bad Voltage and Frequency." Volume 04, Issue 03 Mar-2017, International Research Journal Of Engineering And Technology (IRJET).

[2]. Shubhdeep Joshi, Tushar Parihar, Varun Kumar Shakya, Pradeep Kumar, Upendra Pal Singh."Detecting Of Power Grid Synchronization Failure On Sensing Frequency And Voltage Beyond Acceptable Range". Volume 6, Issue 4, April-2017, International Journal Of Advanced Research In Electrical, Electronics And Instrumentation Engineering.

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

[4]. Laukikraut123@gmail.com,

[5]. kshahrukh.kpathan@gmail.com