
IJAREEIE

e-ISSN: 2278-8875
p-ISSN: 2320-3765

# International Journal of Advanced Research

## in Electrical, Electronics and Instrumentation Engineering

Volume 9, Issue 9, September 2020

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 7.122

| e-ISSN: 2278 – 8875, p-ISSN: 2320 – 3765| www.ijareeie.com | Impact Factor: 7.122|

|| Volume 9, Issue 9, September 2020 ||

# Detection of Power Grid Synchronization Failure System on Depicting Sources, Line and Grid Base Analysis

**Prachi Dhole [1], Prof. K. Chandra Obula Reddy[2]**

M.E Student , Department of Electrical Engineering, Matsyodari Shikshan Sanstha's College of Engineering & Technology, Jalna, Dr BAMU University, Aurangabad, India[1]

H.O.D., Department of Electrical Engineering, Matsyodari Shikshan Sanstha's College of Engineering & Technology Jalna, Dr BAMU University, Aurangabad, India[2]

**ABSTRACT**:. In this paper, we reflect the development of a system to trace the synchronization failure of any external supply source to the power grid on sensing the abnormalities in frequency and voltage levels. There are many power generation units inter-connected to the grid such as hydel, thermal, solar etc. to supply power to the load. These generating units having responsibility to supply power according to the rules and regulation of the grid. These rules involve maintaining a voltage variation within reference limits and also the frequency. So it is convenient to have a system which give alerts the grid in advance so that alternate arrangements are kept on standby to avoid complete grid failure. 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 to totalgrid failure. We are planning to implement microcontroller monitors and control the under/over voltage being derived from a set of comparators and a standard Arduino or control unit is used to vary the input voltage to test the functioning grid for proper synchronization .

**KEYWORDS:** Current variation, Voltage variation, islanding, smart grid, LCD (liquid-crystal display).MC (microcontroller)

## I. INTRODUCTION

In The project is designed to find out the synchronization failure which occur in power distribution systems, the power grid station collecting supply from various feeder stations such as a thermal power generating station, a wind power generating station, a solar power generating station etc. For suitable level of transmission, the frequency and voltage of the AC supply should be within the specified limits as decided by the grid. There are lots of power generation units connected to the grid such as hydro, thermal, solar etc. to provide supply power to the load at different locations. These generating units want to supply power as per requirement need of the rules of the grid. These rules includes maintaining a voltage fluctuations within limits and also the frequency. This prevents in large scale brown out or black outof the grid power. So it is convenient to have a system which can give warning alert the grid in advance so that backup arrangements are kept on standby to avoid total grid failure. In case these limits increased by reference value and the demand for power consumption is more than the demand for supply generation , it results in grid shutdown or failure. In such type of situations, the feeder unit is completely isolated from the grid, causing islanding situation. Thus synchronization is needed amongst the grid and the feeder unit. This paper give suggestion a way to trace the fluctuations in frequency and voltage of the power supply from the feeder unit to determine the synchronization failure. Here a frequency variation in different levels detection system and a voltage variation detection system are used. For frequency fluctuation, voltage variations, and for the current variations we implement the sensors here. In case of any voltage, frequency fluctuations or variation, the lamp is switched on .of any external supply source to the power grid on sensing the abnormalities in frequency and voltage. The project can be improved by implementation of power electronic devices to separate the grid from the erring supply source by sensing cycle by cycle variation for more sophisticated means of detection or sensing

| e-ISSN: 2278 – 8875, p-ISSN: 2320 – 3765| www.ijareeie.com | Impact Factor: 7.122|

|| Volume 9, Issue 9, September 2020 ||

## II. CONSTRUCTION & WORKING OF PROPOSED SYSTEM

.

A. Basic constructional components of proposed system

The block diagram containing all necessary components of the tracing power grid synchronization failure of system on sensing frequency or voltage beyond the acceptable range. Figure given below is the Block Diagram of the Detecting Power Grid Synchronization Failure System on Sensing Frequency or Voltage Beyond the Acceptable Range by using microcontroller At mega 328. Transformer in tracing power grid synchronization failure system on sensing frequency or voltage beyond the predefined range, the transformer is used for step down the ac voltages. It steps down the 220V ac into 12V. Bridge Rectifier in tracing power grid synchronization failure system on sensing frequency or voltage beyond the predefined range, the bridge rectifier is used for converting the ac voltages into dc voltages for supplying the voltages to the other electronics components. Block Diode in given system, the blocking diode is used for block the reverse. polarity current for protecting the transformer. Voltage regulator in to find out power grid synchronization failure system on sensing frequency or voltage beyond the predefined range, the voltage regulator is used for regulating the dc voltages.

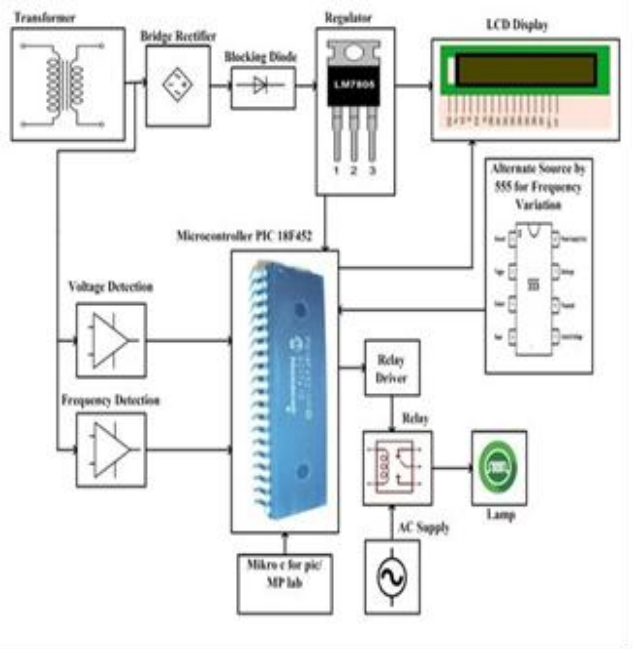



Fig.1 Block Diagram of Proposed Method

LCD display in circuit to find out power grid synchronization failure system on sensing frequency or voltage beyond the predefined range, the LCD display is used to show the supply frequency and voltages of different sources on display. It is interfaced &connected with microcontroller and powered up with 5V dc.Voltage detector in circuit to find out power grid synchronization failure system on sensing frequency or voltage beyond the acceptable range, the voltage detector is used for detecting the voltage of voltage source. Frequency Detector: in circuit to find out power grid synchronization failure system on sensing frequency or voltage beyond the predefined range, the frequency detector is used for tracing the frequency of supply source and operational amplifier is used for this particular purposes. Microcontroller Atmega328P in circuit to find out power grid synchronization failure system on sensing frequency or voltage beyond the predefined range, the microcontroller is used for the smart control of this proposed system. It is powered up with 5V dc and is interfaced & connected with LCD display and voltage, frequency detectors. Alternate Source: In this system, the 555-timer integrated circuit IC is used as analogous to alternate source. The frequency variation done by using this IC. Relay Driver in this system, the driver IC is used to operate the load relay and is interfaced & connected with microcontroller. Relay in proposed system, the load relay is used for switch make on or off the output load and it consists of normally open and close contacts. Load: In this system, the lamp connected in circuit which use as an output load.

| e-ISSN: 2278 – 8875, p-ISSN: 2320 – 3765| www.ijareeie.com | Impact Factor: 7.122|

|| Volume 9, Issue 9, September 2020 ||

B. Working principle of proposed system

The tracing power grid synchronization failure system on sensing frequency or voltage beyond the predefined range is work on the principle of continuously sensing of voltage and frequency of supply sources. In this proposed system, the microcontroller detect the supply voltage and frequency with help of operational amplifier, then these voltages and frequency are matched with the alternate supply voltages and frequency. If the both values are matched, then the microcontroller send the logic high signal to relay driver IC then, this relay driver IC switch make turn on the load relay, on which the lamp is directly connected. Similarly, if the both are not matched then the microcontroller turn off the output load through relay driver IC. In this for the demo , we can easily make variation in the alternate source frequency and voltages and check the working of this system by turn on or off the lamp. This system connected to power supply and LDC display has been used here for observing the supply voltages and frequency of both sources.

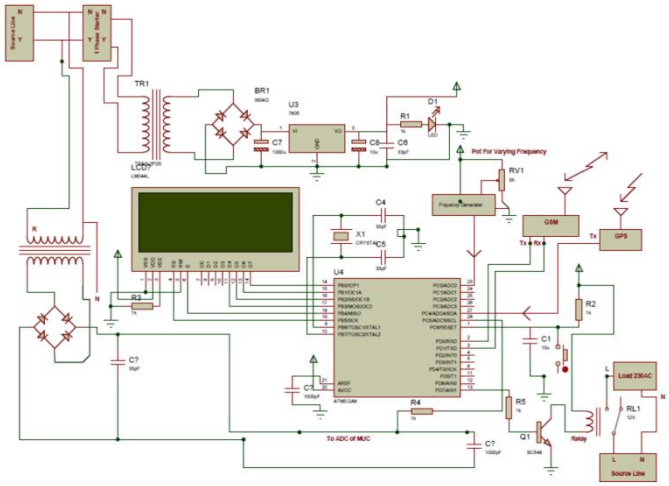


Fig.2 Circuit diagram of Proposed Method

C. Operation of circuit

Islanding of grid is by means to manage two main parameters .Amongst that one parameter is voltage and other parameter is frequency. Since we cannot change the frequency we have taken a 555 timer in a freerunning a stable mode, the frequency of which can be varied by R. We know that by the R & C combination, the multi-vibrator mode of the 555 timer output can be generated at different frequencies. This output is given to the MC pin 3.0 of port 3 of MC which has the provision of changing the frequency 46Hz – 54Hz by varying R as explained above through selector slide switch. So, the MC will changed frequency at pin 3.0 of port 3. We also have provision of feeding the direct frequency at pin 3.0 of port 3 by the selector slide switch since we are not sure of the direct frequency and it may be approximately always near 50Hz it is difficult to check it. This is the main reason, for that we use a 555 timer for giving precisely 52Hz or 50 KHz or 49 KHz which has to be tested by the predefined in build program. In the program it is so design that if the output from 555 timer which is connected to the MC goes to below 48 Hz lower limit or above 52Hz upper limit the corresponding outputs of MC will show high , which will result in turning "ON or OFF" a load to indicate that the islanding has occur due to frequency.

So far as the voltage is concerned we have taken two comparators. Both the comparators are given to i.e., one for inverting input and other for non-inverting input which are given at a particular voltage value. Initially they are so adjusted that the output of these two comparators going to MC pin 0.1 and pin 0.2 of port 2 remain high for low voltage and for the high voltage it is set at low. So, when the input voltage changes at R8 which is a rectified voltage which is coming from the DC voltage, when the input voltage varies i.e., if it goes high, and if it goes low to the microcontroller. That is how the low-high, high-low commands are manage by microcontroller then the program takes executed.

| e-ISSN: 2278 – 8875, p-ISSN: 2320 – 3765| www.ijareeie.com | Impact Factor: 7.122|

|| Volume 9, Issue 9, September 2020 ||

Fig.3 hardware of Proposed Method

## III. RESULT AND PERFORMANCE ANALYSIS

The required output of power supply which is 5v is connected to the 40th pin. Pin 0.0, pin 0.2 of port 0 of microcontroller are made connection 1st LM339, 2nd LM339 & Relay in circuit. Pin 2.0 to pin 2.7 of port 2 of microcontroller are connected to data lines of LCD. Ability of Read, Write & Enable pins output is given to LCD are given to pin 3.5, pin 3.6, pin 3.7 of port 3 of microcontroller. Pin 3.4 of port 3 of microcontroller is made connection to side switch. The microcontroller is made connection with the zero voltage sensing circuit to ensure the frequency of the supply is at normal frequency of 50Hz. A VARIAC is used to get variable voltage. Initially both the predefined values are adjusted in such a way that both the output pins of the OP-AMP IC are at normal low level and normal high level. The VARIAC is adjusted so as to get the input AC voltage more than the normal value. Now the normally high pin of the OPAMP IC will go low, giving an interruption pulse to the pin of the microcontroller. The microcontroller gives a high logic pulse to switch on the relay driver, which in turn energizes the relay and the lamp glows as it gets the AC power supply. Similarly when the VARIAC is adjusted so as to get input AC voltage less than the normal value, at some point, the normally low pin of the OPAMP IC showing high and the microcontroller on receiving this interruption, sends a high logic signal to the relay driver to switch on the relay and hence the lamp which starts glowing.

| Voltage (V) | LCD Display | LAMP Indication |
|---|---|---|
| Below 210 | V=207V<br>F=50Hz | OFF |
| 210 - 230 | V=217V<br>F=50Hz | ON |
| Above 230 | V=231V<br>F=50Hz | OFF |

Table- 1: Voltage and lamp condition

| e-ISSN: 2278 – 8875, p-ISSN: 2320 – 3765| www.ijareeie.com | Impact Factor: 7.122|

|| Volume 9, Issue 9, September 2020 ||

| Frequency (Hz) | LCD Display | LAMP Indication |
|---|---|---|
| Below 47 | V=224.5V<br>F=43Hz | OFF |
| 47- 53 | V=223.75V<br>F=50Hz | ON |
| Above 53 | V=225V<br>F=53Hz | OFF |

Table- 2: Frequency and lamp condition

## IV. CONCLUSION

A simple and cost-effective system is developed and design in this paper. This method is used to trace fault of the power grid synchronization failure on the basis of voltage and frequency fluctuations To provide power to the load the rules of grid involve maintaining a voltage in the limits and the frequency as well. If any deviation from the range of the grid occurs then it is compulsory that the grid should automatically get disconnected. This prevents in large scale brown out or black out of the grid power by sensing abnormalities of voltage and frequency. A simple and cost-effective system is developed and design in this paper. This method is used to trace fault of the power grid synchronization failure on the basis of voltage and frequency fluctuations To provide power to the load the rules of grid involve maintaining a voltage in the limits and the frequency as well. If any deviation from the range of the grid occurs then it is compulsory that the grid should automatically get disconnected. This prevents in large scale brown out or black out of the grid power by sensing abnormalities of voltage and frequency.

## REFERENCES

[1] "Power Grid Synchronization Failure Detection," AmanPratap Singh1, Vivek Kumar2, Shreya Chaudhary3, Journal of Energy Research and Environmental Technology (JERET) p-ISSN: 2394-1561; e-ISSN: 2394-157X; Volume 4, Issue 1; January-March, 2017, pp. 15-17

[2] Prakhar Pandey1 Sawan Kumar Sharma2 "Detecting Power Grid Synchronization Failure on Sensing Bad Voltage or Frequency" IJSRD - International Journal for Scientific Research & Development| Vol. 6, Issue 01, 2018 | ISSN (online): 2321-0613

[3] Inntiaz A R1, Md Maaz2, Jinka Varalakshmi3, Heena Kousar4, Hanumantha Reddy5, Rajashekar "Detecting Power Grid Synchronisation Failure on Sensing Frequency or Voltage beyond Acceptable Range" International Journal for Research in Applied Science & Engineering

[4] Technology (IJRASET) Volume 5 Issue IV, April 2017ISSN: 2321-9653

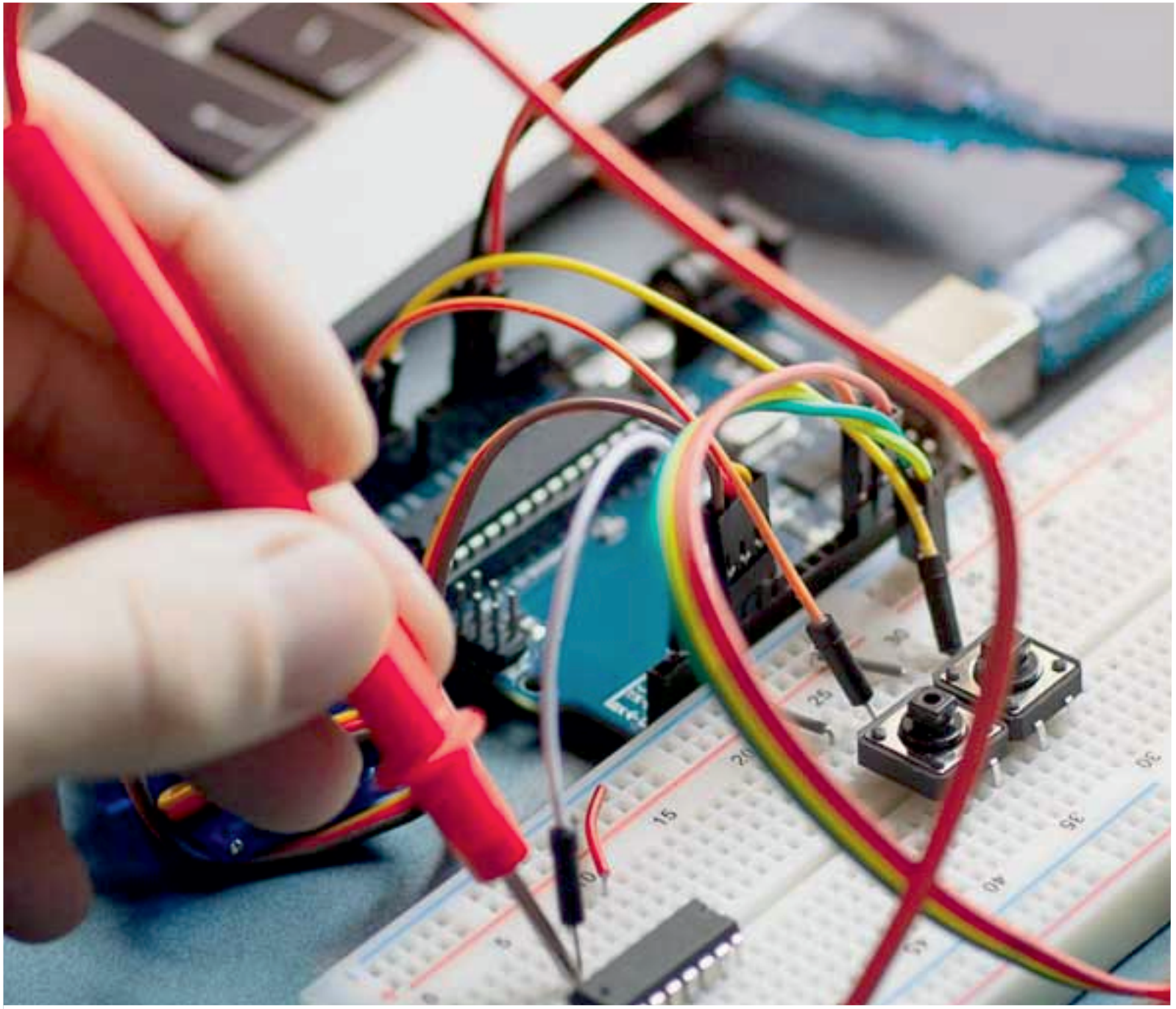
[5] Mohit Gera1, Vikram Singh2, Ram Kr. Pandey3, Sonu Jaiswal4, ―detection of power grid synchronization failure, ‖ International Journal of Current Trends in Engineering & Research (IJCTER) e-ISSN 2455 – 1392 Volume 3 Issue 5, May 2017 pp. 103 – 106.

[6] 1 B.NagaSarvani, 2 B.VineelaThulasi, 3 K.Rahul , 4 K.Satish Kumar, 5 V.D.Sekhara Varma. "detection of power grid synchronization failure on sensing frequency and voltage beyond acceptable range and load protection" International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 Volume: 04 Issue: 07 | July -2017

[7] SabitaMaharaj, Quanyan, Yan Zang, StienGjessing, Tamer Basar, Simula Res. Lab., Formebu, Norway. IEEE paper on "Response management in smart grids in largely populated regions" IEEE Transactions on Smart Grid (vol:7, Issue: 1), 1 June 2015

[8] Moussa Reda Mansour, Luis Fernando, Costa Alberto, Rodrigo Andrade Ramos, University of Sao Carlos, Brazil. IEEE paper on "Preventive control design for voltage stability considering multiple contingencies". IEEE Transcriptions on Power Systems (vol: 31, Issue: 2), 30 April 2015.

[9] Shuhui Li, Julio Proano, Dong Zang. IEEE paper on "Micro grid power flow study in grid connected and islanding modes under converter control strategies". IEEE 2012.



INNO SPACE
SJIF Scientific Journal Impact Factor

Impact Factor:
7.122

ISSN INTERNATIONAL STANDARD SERIAL NUMBER INDIA

निस्केयर
NISCAIR

# International Journal of Advanced Research

## in Electrical, Electronics and Instrumentation Engineering

9940 572 462 6381 907 438 ijareeie@gmail.com

www.ijareeie.com

Scan to save the contact details