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Smart Synchronization of Power Grid by Sensing Voltage and Frequency

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ABSTRACT: **"Smart Synchronization of Power Grid by Sensing Voltage and Frequency".** This 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 hydro, thermal, solar etc. to a power to the load. These generating units need to supply power according to the rules of the grid. As per CENTRAL ELECTRICITY AUTHORITY OF INDIA Regulations 2010, variation of the system voltage should be +-5% and make all efforts to operate at a frequency close to 50Hz and shall not allow it to go beyond 49 to 51Hz. These rules involve maintaining a voltage variation within the limits and also 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. This prevents in large scale 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. And for that we used an Open-Source app (BLYNK) in the system. Which send a message to operator whenever synchronization failure occurs. So, we can make our system stable by keeping voltage and frequency within allowable limit.

KEYWORDS: Power Grid, Synchronization, Voltage, Frequency, Limits

I.INTRODUCTION

In modern power system, electrical energy from the generating station is delivered to the ultimate consumers through a huge network of transmission and distribution system. As power cannot deliver directly from the generating station, it comes from a Power Grid. But Power Grid is not a generating station. So, there are several power generation units connected to the grid such as hydro, thermal, solar, wind etc to supply power to the load. Thus, for satisfactory operation of loads, it is desirable that consumers are supplied with substantially constant voltage and frequency.

In this project we present the development of a system to detect the synchronization failure of any external supply source to the power grid on sensing the abnormalities in voltage and frequency. As if there are any abnormalities in voltage and frequency is detected then that feeder should get disconnected from the Power Grid and other system kept on standby to avoid total Black out of a Power Grid

II.NEED OF PROJECT

An AC generator cannot deliver power to an electrical grid unless it is running at the same voltage and frequency as the network (Grid). If any deviation from the acceptable limit of the grid it is mandatory that the same feeder should automatically get disconnected from the grid to avoid total black out of the grid.
In this project, whenever there is a synchronization failure occurs (i.e., voltage and frequency are not in a permissible limit) the same feeder get disconnected from the grid and microcontroller sends a message to the control panel of a generator and on the other hand, on the basis of our app one message goes to the operator. This will alert the concerned staff to take necessary corrective action. This prevents a further damage of a generator by reducing the fault time of generator. Hence, we can avoid the total black out of the power grid.

III.SYNCHRONIZATION

Synchronization means the minimization of difference in voltage, frequency and phase angle between the corresponding phases of the generator output and grid supply.

In order to synchronize a generator to the grid, four conditions must be met:

1. Phase Sequence The phase sequence (or phase rotation) of the three phases of the generator must be the same as the phase sequence of the three phases of the power grid.

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2. Voltage Magnitude The magnitude of the sinusoidal voltage produced by the generator must be equal to the magnitude of the sinusoidal voltage of the grid.

3. Frequency The frequency of the sinusoidal voltage produced by the generator must be equal to the frequency of the sinusoidal voltage produced by the grid.

4. Phase Angle. The phase angle between the voltage produced by the generator and the voltage produced by the grid must be zero.

IV.PROPOSED SYSTEM

The block diagram of our proposed system is as shown in figure

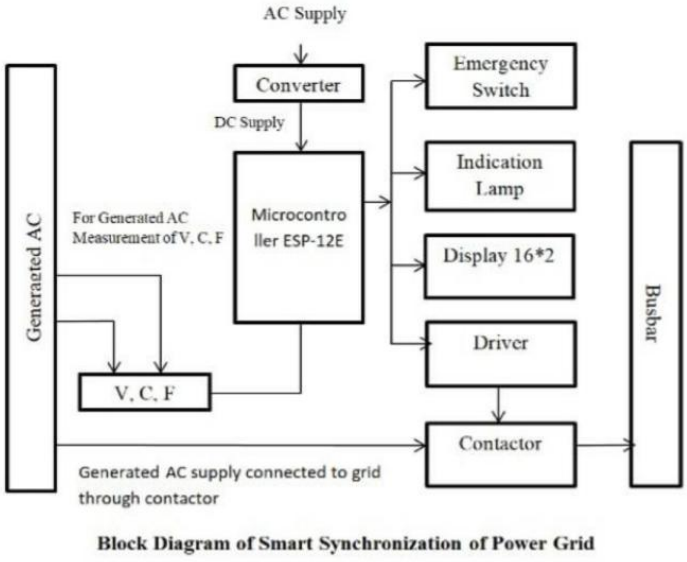

Fig. 1 Block Diagram

V. COMPONENTS

- ESP-12E(Micro-controller)
- PZEM004T (Power monitor)
- Diode IN4007
- Capacitor
- Transformer
- Regulator IC 7805
- 16*2 Lcd Display
- Indication Lamp (Red/Green)
- Emergency button
- Transistor • Resistor
- Converter
- Driver
- Contactor

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VI. ESP-12E(MICRO-CONTROLLER)

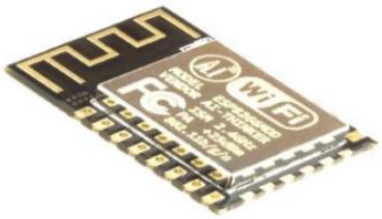

Fig. 2 ESP-12E Wi-Fi Module

ESP-12E is a miniature (Small) Wi-Fi module present in the market and is used for establishing a wireless network connection for microcontroller or processor. The core of ESP-12E is ESP8266EX, which is a high integration wireless SoC (System on Chip). It features ability to embed Wi-Fi capabilities to systems or to function as a standalone application. It is a low-cost solution for developing IoT applications

VII. PZEM004T(POWER MONITOR)

Fig. 3 PZEM004T Module

PZEM-004T Multi-function AC Power Monitor is very popular in electrical consumption measurement projects. It is capable of measuring four interrelated electrical variables as voltage, current, power, and energy.

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VII. DRIVER CIRCUIT

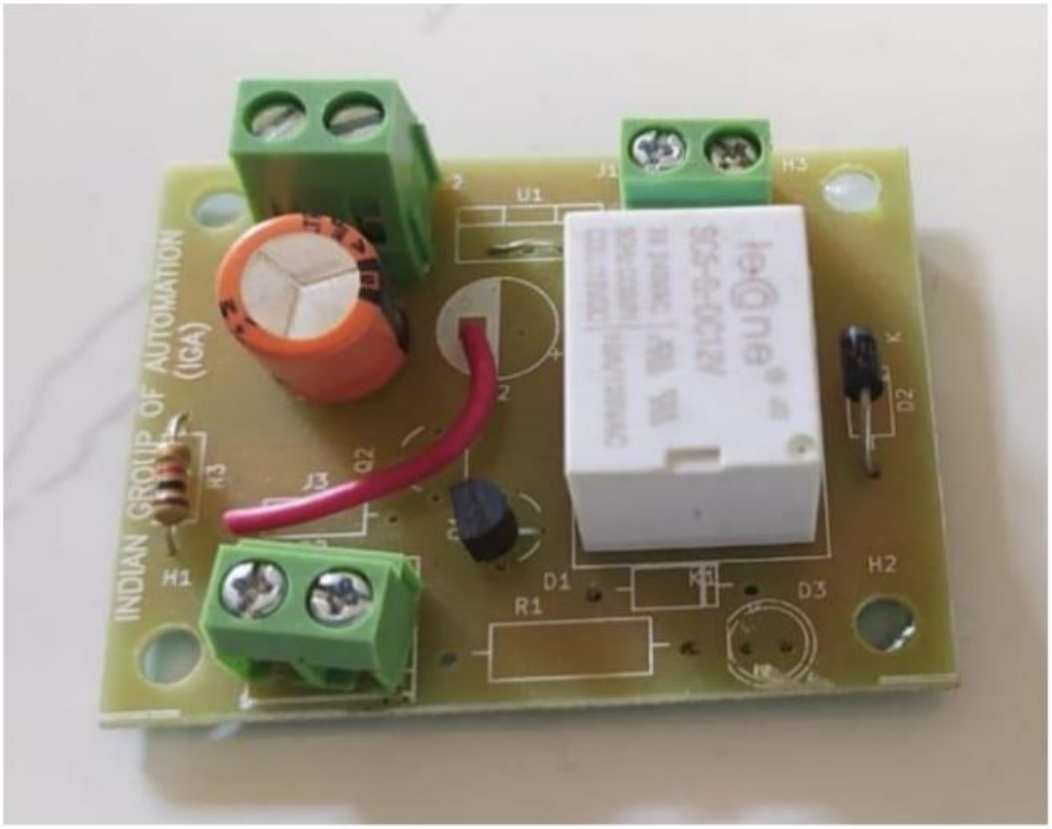

Fig. 4 Driver Circuit

Relay Driver IC Circuit: Relays are components that permit a low-power circuit to control signals or to switch high current ON and OFF which should be electrically isolated from controlling circuit. In order to drive the relay, we use transistor and only less power can be possibly used to get the relay driven.

IX. CONTACTOR

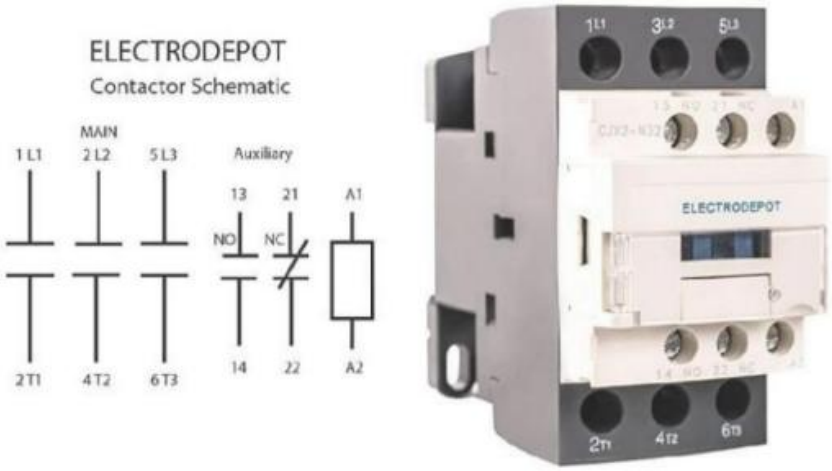

Fig 5. Contactor

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A contactor is an electrical device which is used for switching an electrical circuit on or off. **Operating Principle of a Contactor:** The current passing through the contactor excites the electromagnet. The excited electromagnet produces a magnetic field, causing the contactor core to move the armature. A normally closed (NC) contact completes the circuit between the fixed contacts and the moving contacts. This permits the current to pass through these contacts to the load. When current is removed, the coil is de-energized and opens the circuit. The contacts of the contactors are known for their rapid open and close action

X. METHODOLOGY

There are several generating units connected to the grid such as solar, hydro, thermal etc. to supply the load.
The generating unit needs to supply power according to rules and regulations of grid. These rules involves maintaining voltage and frequency variations with in permissible limits.
If voltage, frequency exceeds these limits then it will affect the grid. It may cause grid failure. This feeder unit is completely disconnected from grid causing islanding.
condition to maintain synchronization needed between the grid and feeder unit

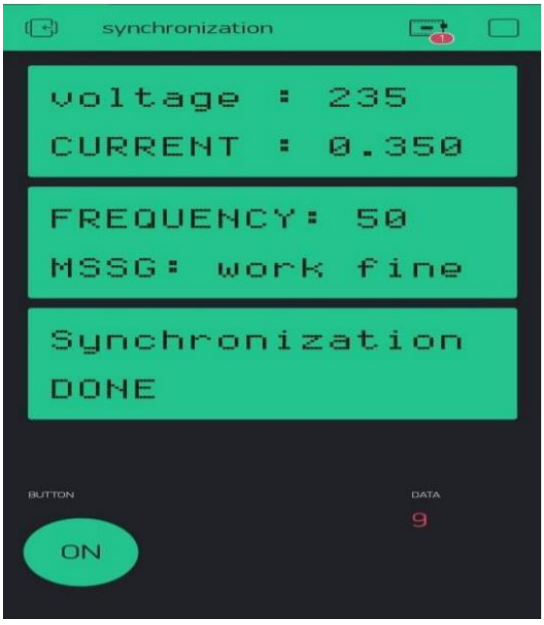
XI. RESULT

After using the system, we have observed the lamp indication based on frequency of the following frequency & voltage range:

Voltage(v)	LCD Display	LAMP Indication
<200V	Low Voltage	Red
220-240V	Stable Voltage	Green
>240V	High Voltage	Red

Frequency (Hz)	LCD Display	Lamp Indication
>48	Display Frequency	RED
48-52	Display Frequency	Green
>52	Display Frequency	Red

Following picture shows updates of the ratings of parameters like voltage and frequency in a mobile of the operator with the help of this operator can monitor the system from anywhere and anytime which helps to reduce the fault time of the system.



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XI. CONCLUSION

In this way, 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. If any deviation from the acceptable limit of the grid it is mandatory that the same feeder should automatically get disconnected. This prevents in large scale black out of the grid power by sensing abnormalities of voltage and frequency. This paper based on the micro-controller ESP12E that having lot of advantages by changing programming. So that alternate arrangements are kept on standby to avoid complete grid failure

XII. FUTURE SCOPE

We implement this project in order to provide continuous grid operation. Now a day there is a need of power with the proper utility. So, this paper gives the information about this system for the future use also. This is used to detection any synchronization failure at power grid then it will sense or detect by sensors. It is by sensing the abnormal conditions of voltage or frequency beyond the acceptable range. By using the simple assembly language programming microcontroller will control all operation. So that it is also economical for the future use. We use this system for detection as well as protection purpose also this is the main benefit and future scope of this system

REFERENCES

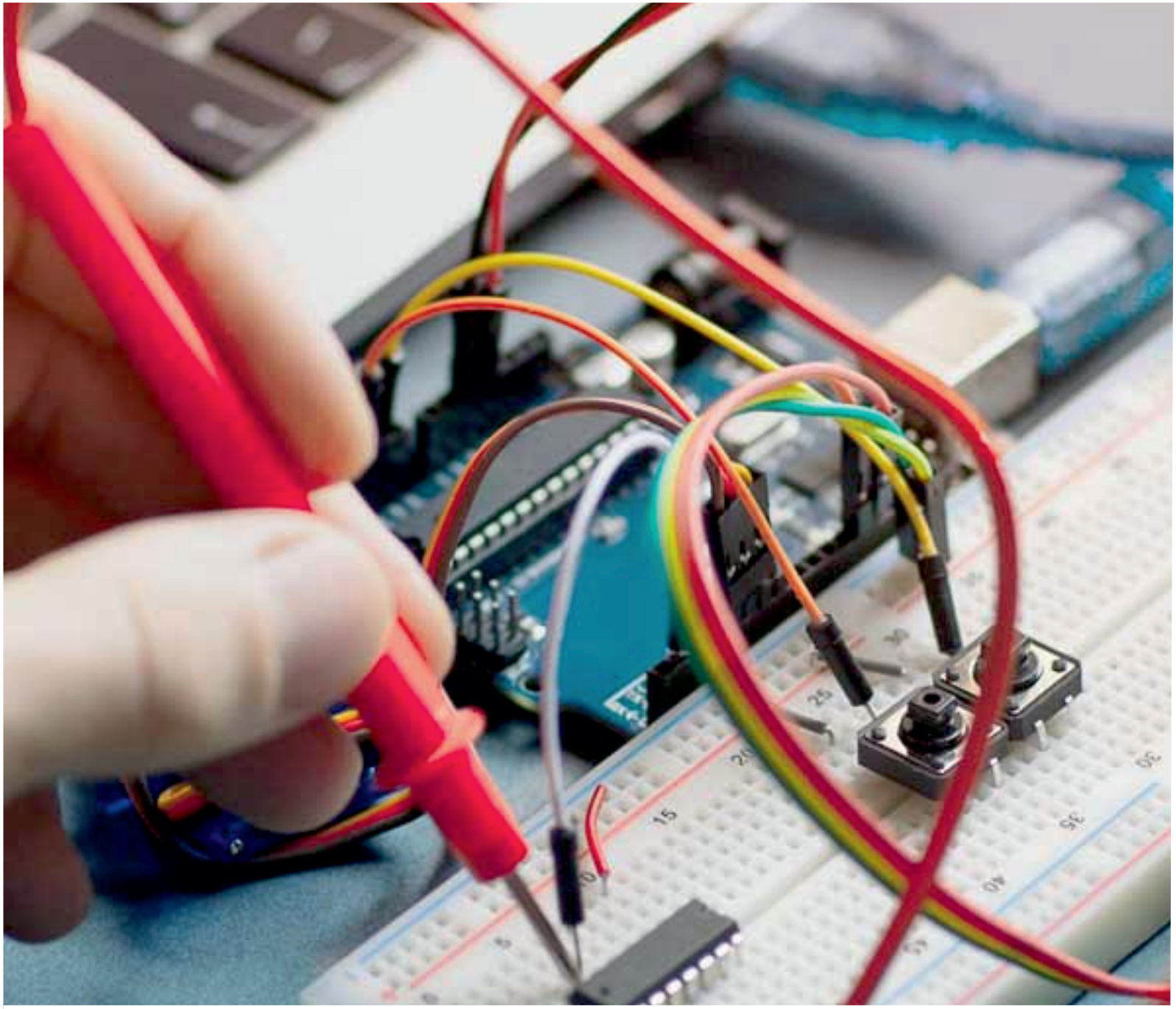
1] Shubhdeep Joshi, Tushar Parihar, Varun Kumar Shakya, Pradeep Kumar, “Detection of power grid synchronization failure on sensing frequency and voltage beyond acceptable range”. R.B.S. Engineering Technical Campus, Bichpuri, Agra, India.

2] Borghetti, C.A. Nucci, M. Paolone, G. Ciappi, and A. Solari, “Synchronized Phasors Monitoring during the islanding maneuver of anctivedstribusion network”, IEEE Transcation on smart grid, pp.160-170,2011.

3] Ajit S Gaikwad, Ch. Malla Reddy, Pravin S Gulhane, “Developing Islanding Detection Arrangement for Grid on Sensing Voltage or Frequency Variation”- International Journal of Innovative Research in Electrical, Electronics, Instrumentation and Control Engineering, Vol. 3, Issue 7, July 2015.

4] Dr. Paul Wright, “The Next Generation of Power and Energy Measurements”-European Meterology Research Programme, March 2011.

5] Karan Gupta, Shreyas Gupta, Kummad Verma, Anil Singh, Abhimanyu Sharma, gave an idea of Detecting 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 the ultimate consumers through a huge network of transmission and distribution. There are several power generation units connected to the grid such as hydro, thermal, solar, wind etc to supply power to the load. Thus, for satisfactory operation of loads, it is desirable that consumers are supplied with substantially constant voltage and frequency



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