IDENTIFYING THE FREQUENCY AND VOLTAGE LEVEL AT THE GRID CONNECTED SYNCHRONISATION FAILURE

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***Abstract*—**
This paper is prepared to the system that sensing the abnormalities conditions of frequency and voltage from the external supply source to the power grid and detects the synchronization failure at any sudden change in the supply to grid connected system. There are many power generating units which will be connected to the grid level synchronization. For any irregularity of the voltages or frequency in the given limits to the grid, it is mandatory that feeder should be automatically detached from the grid side which gives the results as Islanding state. This may hazards to the large systems of cause the injury of grid system. To avoid these hazards condition before operating the grid connected system, better to keep one alarm to improve the grid synchronization failure an alternative arrangements can be reserved standby to avoid whole system.

Key Words: **Regulator, LM339, BC547, 555Timer, MC and LCD Display**

I. INTRODUCTION

This paper provides an idea that seems rather imminent today and supplements them with a few visionary thoughts. Numerous new movements are already creative variations in the electric utility infrastructure including the extension of the current grid with micro grids and mega grids, widespread sensors, etc... It will results to impression of Automatic Grid synchronization conception. By increasing the electrical energy to the load side demand, the lifestyles become changed and energy used system have made the world population fully dependent on power systems energy level, which have the need of a consistent and constant power system to the grid level. Eve though, the power system has the highly nonlinear systems, which having variations it's operating of energy generating endlessly. Consequently, it is more stimulating and uneconomical to create the power system be stable for all turbulence. The system has designed regularly to handle a single outage at a time [1]. But, during the past decade numerous major brownouts were stated and all of them in progress with single outages. This paper primarily based on techniques to minimize blackouts.

The distributed generators will be developed based of the rank of the electric utility of power system and additional to this the power system parameters have the well-organized in the way to assurance the suitable process of the electric utility. One of the major problems having with the power system generations plant to develop the potential of islands which may be employed in a standard way proceeding of electric utility if the grid has failed. There will be numerous power generations sources associated to the grid such as wind energy, hydel power, thermal power, solar energy etc.… to resource power for the consumer. These power generating sources needed to supply power by considering the guidelines of the Indian policy to the grid side. These guidelines of Indian policy hold possession a voltage and frequency variation within boundaries [3]. The direction of central electricity board authority of India Guidelines 2010, deviation of the power system voltage would be of $\pm$ 5 percent and the frequency should operate nearby 50 Hz and further frequency should drive within this value of 49.2 to 50.3 Hz or slightly variant of frequency specified at the gird coding, except at the transient condition for subsequent the tripping operation. If slightly deviance from the appropriate boundary at the grid level, so, it is necessary that like feeder should operate automatically become detached from the grid side which may be result as islanding. This will breaks in enormous measure the brown-out or black-out of the grid power synchronization. Thus, it is needed to have proceeding the power system which be able to attention the grid in the advance, so that substitute preparations will be reserved for backup to avoid whole grid level failure. Islanding indications to the condition of the distributed generator (DG) endures to power a location, though electrical grid power from the electric utility is no lengthier.

Islanding will be hazardous to electric utility labors, who may not be comprehend the situation in the circuit still supplying the power, and we can avoid the automatic reconnect of the load side devices. The collectively information were made for islanding mode of operation to the grid connected supply that will be having solar power panels attached to the grid system. In the condition of the black-out, the solar power panels continuing to generate the power for continuously if the irradiance is enough. By having this circumstance, the sources line turn out to be an "island" with power surrounded by a "SEA" of unpowered to the lines. For this shake, the purpose of solar power inverters are planned to supply the power to the grid level. Grid are required to have the automatic anti-islanding electrical system. Electrical circuit inverters are convert the DC to AC [4]. Grid-cooperative inverters are having the necessity is that, they will generate AC power supply to the contests of the current power accessible for the grid. Considering this circumstance of a house system by an array of solar power panels on the roof Inverters are attached to the panels and will convert the variable DC

current provided that by the panels into AC power that makes equals the grid supply [5]. If the grid is detached, the voltage level at the grid side probable to drop to zero and a clear suggestion will be given as an indicator that services disruption. Although, considering this cases at the time of house load exactly able the output of the solar panels at the instant of the grid disturbance. In this context the solar panels can supply the power continuously, which may be used to house's hold load. At this situation there is no clear indication that interruption has been occurred. Generally, when the load and production are correctly matched called as balanced-condition, will give the failure of the grid can effect in numerous added transient signals will be developed [2]. Like one example, the voltage is almost decreasing in line voltage, which is having a signal of potential fault condition. Though, such activities can measure the normal operation mode, like the starting of the huge electric motor.

II. HARDWARE REQUIREMENTS

A. *Main Block Diagram*

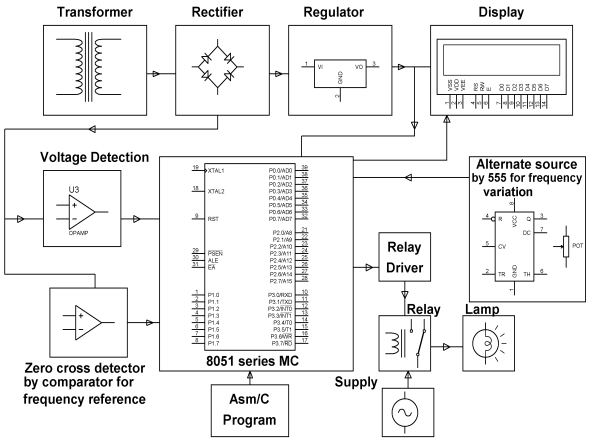

Fig.1: Basic Block Diagram

Hardware components of the Transformer are having the voltage range: 230V – 12 V AC supply, the Voltage regulator of LM 7805, Rectifier circuit, Filter, LM358, LM339, BC547, IN4007, Microcontroller: AT89S52/AT89C51, 555-Timer, Liquid Crystal Display:LCD

i. TRANSFORMER

Transformer will convert the AC signal from the primary voltage to the secondary voltage with a slight loss of power. The Step-up transformers will increase the voltage and step-down transformer will reduce the voltage. Almost power supplies will be used of step-down transformer to reduce the hazards high voltage to a small voltage harmless.

The input source side of the transformer winding is called the primary winding and the output load side transformer winding is called the secondary winding. In between these too primary winding and secondary winding there will be no electrical connection manually instead of this there will be like alternating current will produce the magnetic field in the iron core of the transformer. The two limb of lines of the in the central of the circuit symbol indicate the core. Transformers excess very little power so that power out is equivalent to the power in. The transformer of the voltage will be stepped down and current will be stepped up.

The ratio of the number of turns having of the primary winding and secondary winding called the turn's ratio, will be determined by the ratio of the primary and secondary voltages. A step-down transformer has the large number of turns on its primary side which will connected to the high voltage of mains supply, and the secondary side of the winding will have the less number of turns will give the low output voltage of the transformer.

ii. Voltage Regulator 7805

The LM78XX/LM78XXA having three terminal portal of positive regulator are available in the TO-220/D-PAK set and will give the numerous within range of the output voltages will create the useful for a widespread range of different applications. This type of employments will have the internal current limiting period and making the principle of thermal end and harmless operating area safety. The temperature sinking is provided at the terminal points and will carry the current over 1 Ampere of the output Current. Though it is planned for primarily secure voltage regulators and these devices can be used with the external components to gain the voltages and currents for required level.

iii. LM339 & BC547

The LM339 will have the four independent voltage comparators with good results of the offset voltages requirement as very low value of 20 millivolt for maximum of each comparator, which will be designed precisely to have a function of power supply to the over a widespread area of the voltages. Procedure of the power supply is possible to have the low power supplies and draws the current which is having independent of the magnitude of current of the voltage power supply. These are the comparators have a unique solution and their characteristic of the input voltage common-mode range contains ground level, though they will operates voltage power supply. The LM339 having series connection is designed to have the straight interface of TTL and CMOS. While operating these two parameters of positive and negative power supplied to the LM339 is directly interface with the MOS logic and low power were drain to distinct advantage in excess of a standard comparators. The NPN Epitaxial of Silicon Transistor is from The BC547 transistor. The BC547 has the general-purpose of transistor is low plastic packages components. These transistors will be used for switching operation mode and it will amplifies the voltages and currents of 45V and 100 mA for N-P-N transistors.

iv. Internal Arrangement of 555 TIMER IC

The timer includes two operational amplifiers composed with an RS Bitable element. Adding this, an inverting output buffer is collective that considering the sourced or sink to the load side. A switch transistor: TR1, will be provided by means of quickly discharging at the capacitor. The 555-timer standard were kept to the 8th pin of DIL and the input of the supply voltage is in between of 4.5V and 15V. This one will be encompasses to the normal range for TTL devices and some other devices is suitable for ideally will be used in combination of TTL.

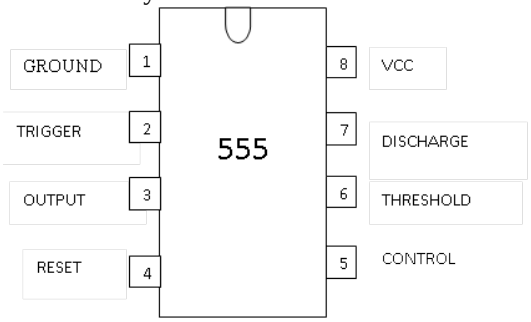

Fig. 2: Pin out diagram of TIMER IC555

B. *Main Block Diagram*

The field of parameters were monitored by the Microcontroller chip by the assistance of user printed with the alert message of LCD and remote monitoring for faulted condition of transmission lines. The IC's of the Microcontroller having input port for giving the fault condition of system parameters and as well as will give the 'Stop' signal through the Radio Frequency signal Receiver. The output of the microcontroller port is used send the fault coding condition to the encoder of DTMF while the relay switching operation is required for isolation of the power from the utilization of load side.

i. AT89S52 Technical Description:

AT89S52 has a low power operating system and high performance of the CMOS with 8-bit microcontroller of 8K bytes flash memory. This device is made of with an Atmel's high density having a nonvolatile storage technology with the industry standard of 80C51 instruction and pin. Turning on chip flash allows the storage program for re-writing the programmed structure in the system or with a conventional non-volatile storage programmer. By combining of 8-bit CPU by programmable flash having monolithic chip. The Atmel AT89S52 has the very important to the microcontroller which will be providing the highly flexible data and cost effective data to the numerous embedded controlling applications. The AT89S52 gives the following standard category likes: flash of 8K bytes, on-chip oscillator, RAM-256 bytes, three 16-bit timer (or) counters, 32 Input/output lines, the timer, full duplex serial port, two data pointers, a six-vector: two-level interrupt architecture and the clock circuitry. Including with the AT89S52 have been developed with a static logic of having operation of down to zero frequency and it will support the two software suitable power saving modes of operation. The main aims to stops the CPU with a permitting of the following the points like: RAM, timer and counters, serial port connection, and interrupt the date system to continuing the working. As Power is going down the operation of RAM protects contents, however, the system is going to be freeze the oscillator and deactivated all other components from the working functions till the next action is going to operate or hardware are going to be reset.

II. Liquid Crystal Display:

LCDs are used for many application in relations of providing the valuable boundary for the worker and correcting. Hitachi 44780 type of LCD controllers simple available a relatively interface between a processor and an LCD. The 44780 type based LCDs has the pins: 14 in a row and pin centers: 0.100".

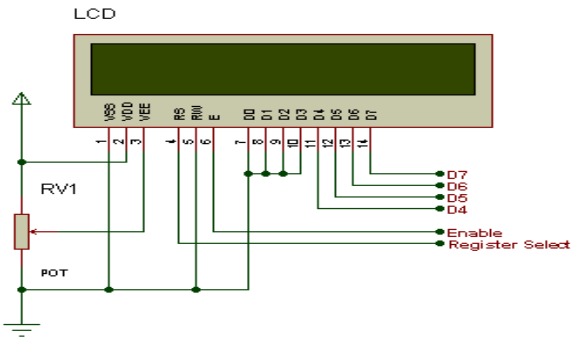

Fig. 3: LCD Display

A. *Processors of Embedded*

Embedded C program used for many applications such as in Automotive electronics, electrical vehicles, automobiles, space systems and in military systems were common, and even day to day life in domestic utilizations like washing machines, telecommunication groups, photographs and video displays.

The common embedded system having projects are multipurpose, cost restrictions, be likely to use low cost computers such as the 8051 domestic devices are measured. The popularity of 8051 IC's are having within the permitted resources accessible main of the such devices are having about RAM has 256-bytes, and the accessible system processor having the power 1000 times less when compared to the desktop computers. Finally the result will be developed with the embedded program of novel challenges, even for the skilled desktop computers.

IV. Experimental Procedure

A. Circuit Connections:

The pin no. 40 is connected to the 5V power supply of the output. The first LM339 is connected to the Pin no. 0.0, the second LM339 is connected to the Pin no.0.1 and Relay is connected to the Pin no. 0.2 as a part of port no. 0 of microcontroller. The LCD of data lines are connected to the Pin no. 2.0 to pin no. 2.7 of the microcontroller of port 2. Read for pin no. 3.5, Write for

pin no. 3.6 and Enable to the pin no. 3.7 of LCD's as a port of 3 microcontroller.

B. Working operation:

Islanding mode of the grid connected system is having the two category. First one voltage and second one is frequency. As per Indian policy the frequency should maintain the 50 Hz and within the frequency range should be maintained, more than this cannot be considered. 555-timer is an astable mode operation and we can vary the frequency by using Resistance (R) value. With the known values of Resistance (R) and Capacitance (C) together the frequency output ranges will be generated with using of multi vibrator of 555-timer. The pin no. 3.0 of microcontroller is the output as port of 3 and has the varying the frequency ranges are in between the 46Hz to 4Hz by using the variable resistance with a selector switching operation, thus it has frequency at pin no.3.0. Now the frequency can be given to the pin no. 3.0 with a switch operation will be given directly frequency of closer to 50Hz, it is very difficult test it. The purpose of choosing the 555 timer is to give the frequency ranges with a selected a ranges of value frequency are 49Hz or 50Hz or 52 KHz which will be tested with 555 timer for this program. In this program, the output of 555-timer which is fed to the microcontroller of 48 Hz below the range or the above 52Hz. The reliable microcontroller outputs will depend on the HIGH which is the switching operation of ON or OFF to the load and it will indicate the islanding mode of the frequency taken part.

According to the voltage behavior we have considered two comparators that is one input is for inverting terminal and other which we have voltage range. Primarily it will be considered as two output comparators connected to the pin no. 0.1 and pin no. 0.2 of microcontroller and remaining will set as low voltage for HIGH and high voltage for LOW. After variant of the input voltage at R8 will give the rectified voltage of DC voltage as HIGH will give the high command to the system LOW for low command of the microcontroller. This program have the command signals are low to high and high to low to the microcontroller program.

i. Adjustment of Low Voltage Trip: The voltage of 220V is set by the VARIAC. Slowly vary the LVSP in the clockwise direction after variation lamp will start glowing. Now don't adjust the settings operation and it will measures the low voltage is 220V and LCD will give the same frequency and voltage will display as low valve.

ii. Adjustment of High Voltage Trip: Select the voltage to 250V by adjusting the VARIAC with a led and lamp will give the OFF and at this condition frequency will measures same value and voltage will give the stable condition. Now vary the HVSP in the direction of anticlockwise direction after this lamp will start glowing which will give the frequency as same value and voltage will measure the high value.

iii. Testing of Voltage Range: Select the voltages range below 220V to higher than the 250V by adjusting the VARIAC. At this condition led and lamp will glow together. In the range of the voltages are 220V and 250V then the led and lamp will not glow and it will measures the value of frequency 50Hz and voltage will give as stable.

iv. Adjustment Frequency Range Trip: When the frequency is given to the inverter location at the voltage under the stable condition, then the LCD will measures the less than the 50Hz frequency and led and lamp will glow. Now adjust the frequency in the counter direction until it will shows the near to the value of 50Hz frequency on the LCD screen. This results the frequency desired value for setting. By varying the frequency of 52Hz above and 48Hz below the led and lamp will glow and on the LCD screen will give the frequency value and voltage will measure the stable condition. For testing of frequency it is very hard to vary the frequency so for this 555 timer is used for inverter output of the frequency.

v. At Normal Condition: In normal condition the led and lamp will not glow, so at this condition frequency will measure the 50Hz and voltage will measure the stable condition. For any abnormality of the voltage collection or the frequency collection the led and lamp will glow together at the grid synchronization failure. This program will be stated that if any cases of frequency is low or high and the voltage may be written that in either high or low, at this condition the microcontroller of the LCD screen will be displayed the grid operation condition, finally relay will operate the ON or OFF to the consumer side load.

C. Measurement of Viscosity

We need to find the room temperature for filling the oil level in the tank, so that cylindrical tank is required for filling oil by the motor. The orifice is used to operate the ball with stop clock-on and stop clock-off. The flow of oil can be measured with desire value.

V. RESULTS

A. Voltage comparison for Under Voltage and Over Voltage conditions

1. Over Voltage Condition:

	Frequency(Hz)	Voltage
Normal Condition	50	Stable
Over Voltage Condition	50	High

Table 1: Over Voltage Condition

1(a): Over Voltage Condition: Normal Condition

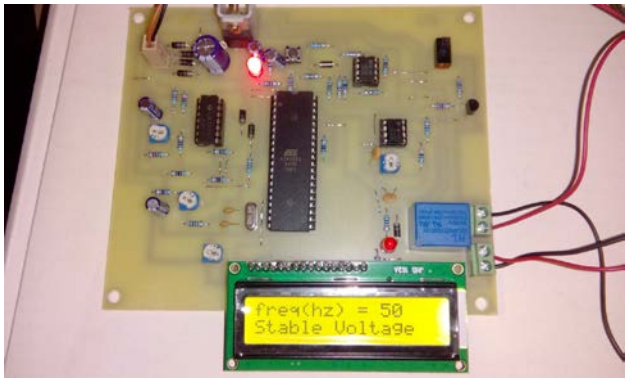

Fig. 4(a): Normal Condition

1(b): Over Voltage Condition: Over Voltage

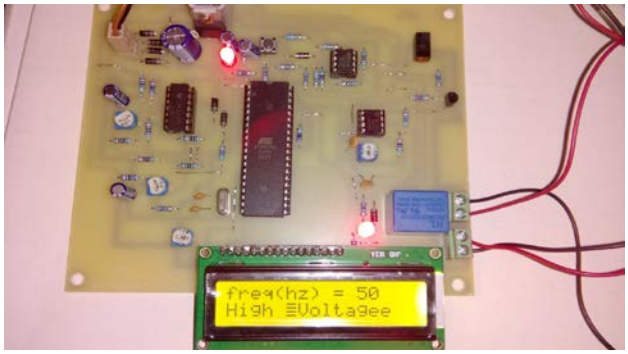

Fig. 4(b): Over Voltage

2. Under Voltage Condition:

	Frequency(Hz)	Voltage
Normal Condition	50	Stable
Under Voltage Condition	50	Low

Table 2: Under Voltage Condition

2(a). Under Voltage Condition: Normal Condition

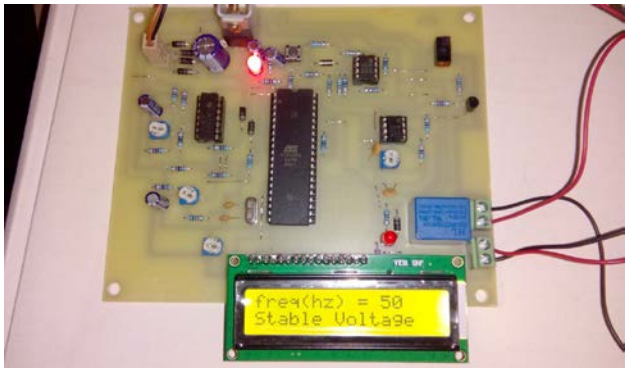

Fig. 5(a): Normal Condition

2(b): Under Voltage Condition: Under Voltage

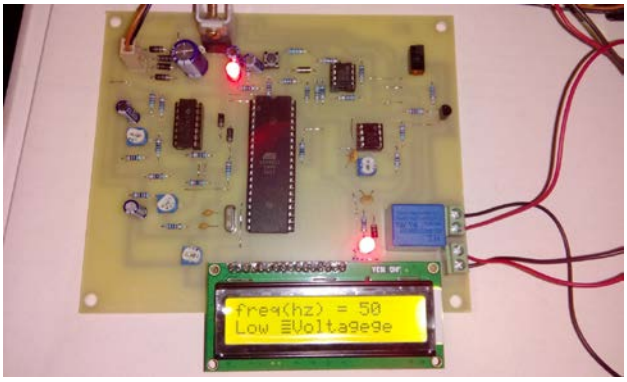

Fig. 5(b): Under Voltage

B. Frequency comparison for over frequency and under frequency conditions

1. Over Frequency Condition

	Frequency(Hz)	Voltage
Normal Condition	50	Stable
Over Frequency Condition	55	Stable

Table 3: Over Frequency Condition

1(a): Over Frequency Condition: Normal Condition

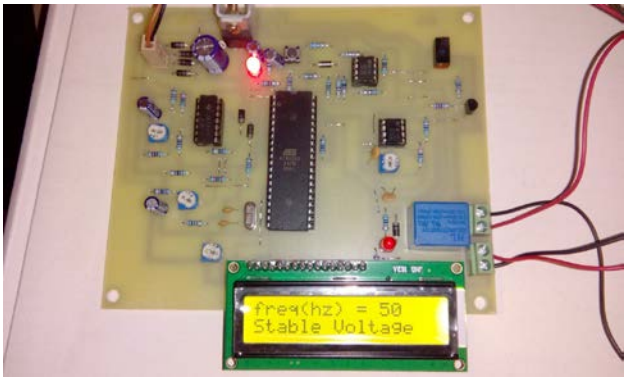

Fig. 6(a): Normal Condition

1(b): Over Frequency Condition: Over Frequency

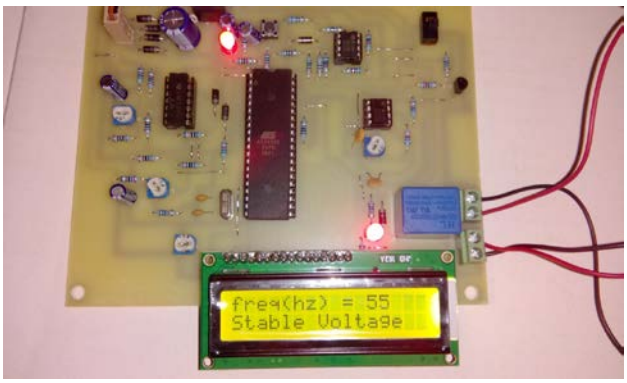

Fig. 6(b): Over Frequency

2. Under Frequency Condition

	Frequency(Hz)	Voltage
Normal Condition	50	Stable
Under Frequency Condition	45	Stable

Table 4: Under Frequency Condition

2(a): Under Frequency Condition: Normal Condition

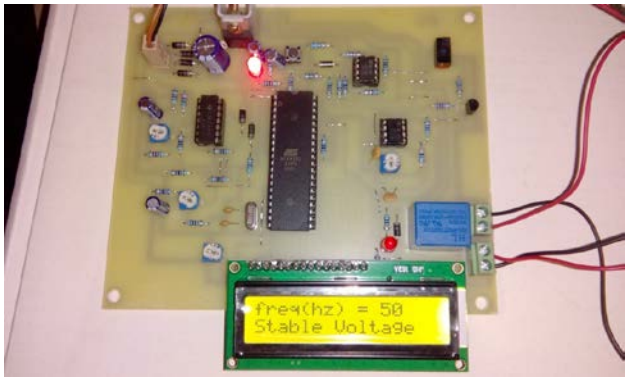

Fig. 7(a): Normal Condition

2(b): Under Frequency Condition: Over Frequency

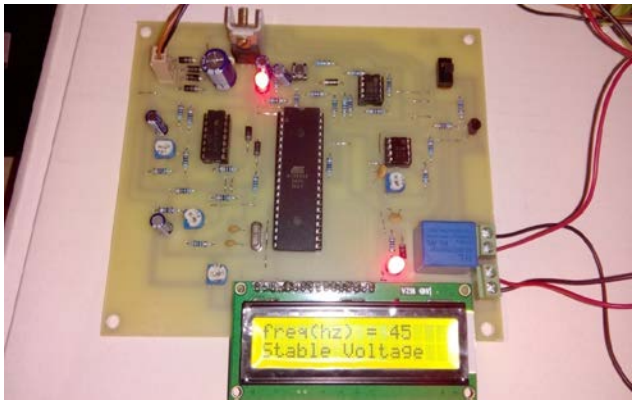

Fig. 7(b): Under Frequency

VI. CONCLUSION

The experimental work carried out based on the hardware implementation using 8051 microcontroller. The microcontroller monitors under/over voltage and under/over frequency conditions which was being derived from a set of 555 timer for the grid synchronization. The results were compared and carried out the best performance.

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