GRID TIE INVERTER

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***Abstract*—** This paper reviews an administration of grid-tied inverter to small scale power system. The GTI converts DC into AC. Grid-tie inverter employs among local electrical power generators. The operation of GTI is carried for 230v dc battery supply, then it is tied with 50HZ 230V ac grid. By using H bridge inverter GTI transform DC voltage to AC voltage. Also the core working is synchronizing the supply which will tied with grid supply with respective of their voltage and frequency. GTI is a environmental friendly evergreen system and saves commercial units with backup power supply. The motive of synchronization is to design the system in such way that its Voltage, Frequency & Phase angle should be equivalent as that of grid. For this in hardware model we use the arduino as a controller (arduino mega 2650). It is done by using hardware and software; we can interconnect between Inverter and utility grid. This paper will give calculations for inverter, PWM technique and filters.

Keywords*—Grid tie inverter (GTI), Arduino, SPWM.*

I. INTRODUCTION

The consumption of electrical energy in the World is continuously ascent. Large primarily moderate conventional power sources attached to transmission system are aggregated or replaced with greater number of inferior renewable energy sources straightly attached to local distribution grid. Power electronic converters serve as an efficient interface between primary energy sources and the utility grid.

As very broad amount of energy is essential in recent Technological word, whole energy sources works there best to complete the requirement of energy. By applying continual energy Sources like Solar, Wind, we can assist to overcome energy crisis. If we think about solar the homelike production of electricity is possible and it may be amounted greater than our need. The extra amount of energy can fed to Electricity Company. For such operation the device used to feed this generated power is known as grid tie inverter.

The electricity produced by any endless energy source will be gathered in the battery. By using inverter or Grid Tie Inverter (GTI) Battery supply i.e. dc will be convert into ac. In Hardware model, we use the MOSFET as a switching or semiconductor device for inverter. To operate this device we use the SPWM technique to provide gate pulse to MOSFET.

The main part of grid is the synchronizing the voltage and frequency. The circuit also used in grid design for protection purpose. In order to implant electrical power adequately & provided that to grid, the Grid Tie Inverter must properly suit Voltage and Phase of the grid Sine AC waveform.

II. DESIGN AND IMPLEMENTATION

1) Power circuit
2) Switching or Control circuit

Power circuit

The power circuit is usually configured from MOSFET or IGBT switches. The simplest power circuit of the inverter is formed from four switches with two parallel to each other as shown. In isolating process the four switches are grouped into two groups.
G1 and G2 form one group
G3 and G4 form another.

When G1 and G2 are in on condition and G3 and G4 is artificially to be off by the signal from the control circuit, the output voltage from the inverter will be in positive. However, if G3 and G4 in on condition G1 and G2 are forced to be off, the inverter will give a negative voltage as the output.

Control circuit

The control circuit comes together with an analog circuit For production of switching signal for inverter power circuit anlog circuit is used. Inverter concern with battery source and inverting to AC power and feed to grid. The current and output voltage of AC grid waveform is sensed by inverter & it corresponds with the grid.

Normally the control circuit is made up from analog op-amp circuit or digital microcontroller or else conjunction of both analog and digital. In the design of inverter, for designing the control signal the pulse width

modulation technique (PWM) is used. SPWM technique removes the harmonic content in output voltage waveform, so in inverter design we used this technique for better quality of output voltage. The SPWM technique is used for mitigate the switching losses.

III. DESIGN OPERATION OF GTI

Inverter operation can be spilt into two parts:

Grid Synchronizing

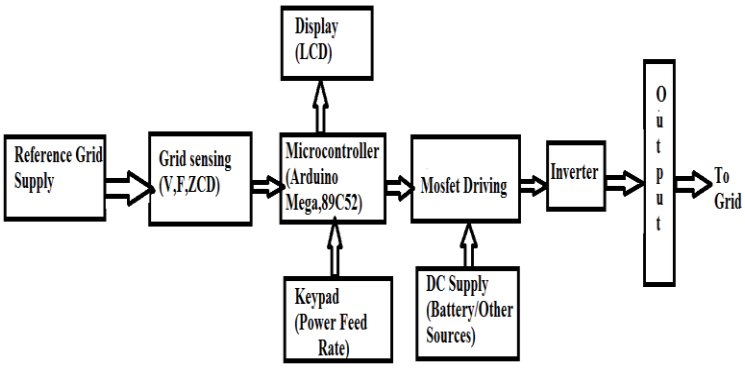
Power transmitting (power sending)

The main motive of project is the power generated by the inverter is synchronizing with the grid. When two things are happening at same time and same speed and they are matching up with each other at that time synchronization comes in picture. The voltage, frequency and phase angle getting from inverter must be synchronizing with grid. If there is any difference between this quantities at that time there will be no synchronization, and it will treated as fault occur.

Between synchronization, the inverter wills rocreate the output in phase with the grid. The output voltage of inverter should be leading the grid voltage with some angle for sending the power into the grid.

This sine wave is rectified and compared with carrier frequency triangle wave to generate SPWM signal. For generating four types of switching signal, an AND operation is experimented among the SPWM and the square wave. .Once the zero crossing of both voltages is exactly same, the system get activated and plugs the grid and inverter together.After both voltages are coupled the inverter commences to send power into the grid.Sometimes where the grid is off,the circuit breaker between grid and inverter trips.This system can prevent from unwanted accidents.

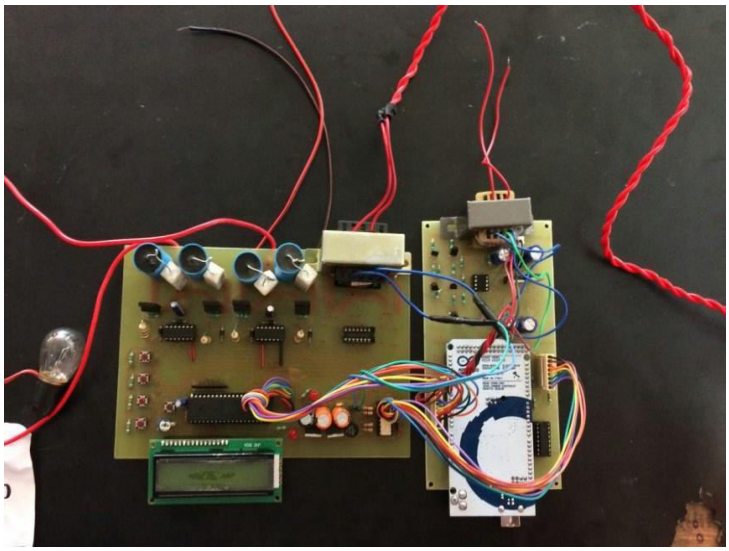
IV. BLOCK DIAGRAM



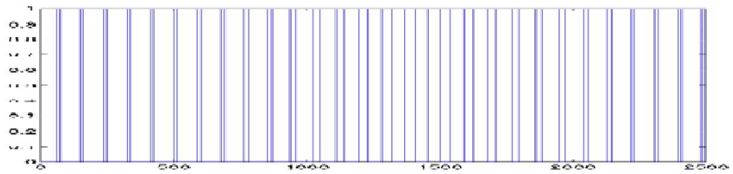
(Block Diagram Description)

The brief description of the system is shown by the block diagram. It contains H bridge inverter, IR2110 MOSFET Driver circuit, Display (LCD), Grid sensing element, Arduino mega (2560), microcontroller (89C52) and power feed rate. For switching purpose, we use the H bridge inverter consists of four MOSFETS. Our requirement such that MOSFET configured as high side switches and low side switch. Here we uses full bridge circuit in which two high side and two low side MOSFETS. so the way of driving the MOSFETS in such condition, use high-low side MOSFET drivers so chip used to drive the MOSFET is IR2110.LCD display is used for showing the angle between the inverter output voltage and grid voltage. we use current transformer or potential transformer to get reference values of voltage and frequency. Arduino Mega 2560 is a is used for getting pwm output for MOSFET Gate terminal. power feed rate block is for showing what amount power is feed by using keypad.

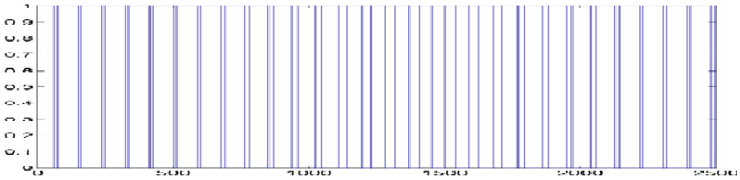
V. CIRCUIT DESIGN



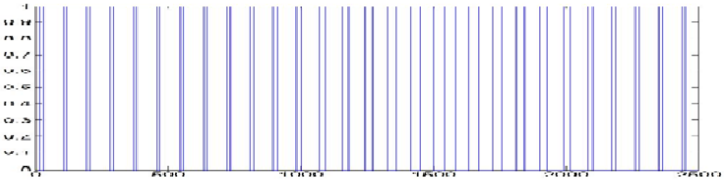
VI. HARDWARE RESULT



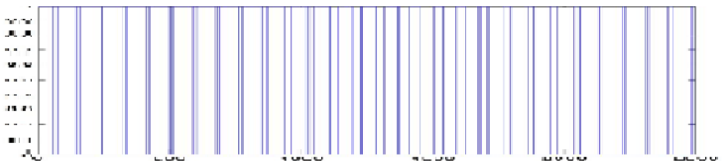
Pulse1



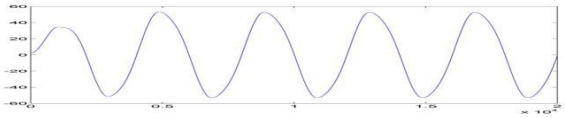
Pulse2



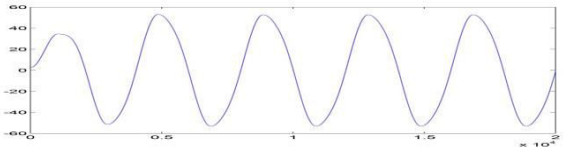
Pulse3



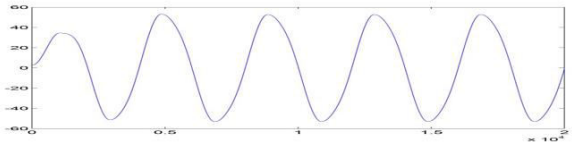
Pulse4



Inverter output voltage



Grid output voltage



Synchronized output voltage

VII. SYSTEM FEATURES

This system is very easy to install or easy to execute. It has minimum cost and also inexpensive in nature, saves more money with net metering. This system is reliable and also flexible. GTI includes high efficiency. This system reduces the use of conventional power generation techniques and also minimizes the existing power demand. This system can greatly reduces the several technical issues regarding with grid connected systems like power quality issue, power and voltage fluctuations, storage, protection issue. It uses computer process to convert power to suitable frequency.

At the time of blackout grid tie inverter will shut down and protect from any harmful accidents.

VIII. CONCLUSION

With this hardware model we successfully synchronize the frequency, phase voltage and phase displacement with the grid and we also feed power to the grid.

IX. FUTURE SCOPE

This project extended to design a high efficiency and MPPT technique is used as a future work. For future expansion instead of using DC supply, for DC-DC conversion we can use PV modules and DC bus. It is used to faster speed of communication &connectivity.

This project can be further invented by using internet of things, such as we can control and feed the power from any place by using internet on mobile.

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