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Implementation on Solar Inverter with Grid Power Generation

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ABSTRACT: Power can be created from either renewable or non renewable sources. Renewable sources are liked to maintain a strategic distance from contamination emanation and rely on upon fossil energizes to decrease. The proposed sun powered vitality transformation unit comprises of a sun oriented exhibit, Bidirectional DC-DC converter, single stage inverter and AC. The inverter changes over DC control from the PV board into AC power and offered it to the heap which is associated with the lattice. The photovoltaic sun powered vitality (PV) is the most direct approach to change over sunlight based radiation into power and depends on the photovoltaic impact. The most extreme power point following of the PV yield for all daylight conditions is a key to keep the yield control per unit cost low for fruitful PV applications. Framework associated PV frameworks dependably have an association with people in general power matrix by means of an appropriate inverter in light of the fact that a PV module conveys just dc power.This project presents the new design, Development and Performance Analysis of a Grid Connected PV Inverter. Demonstrate that the proposed framework can lessen the Energy Consumption radically from the power board and give a solid support to the Grid.

I. INTRODUCTION

Vitality request in India both in urban and provincialranges in cease lessly expanding, however the power utilities can't meet this quickly expanding request. This is the motivation behind why the vast majority of the business structures, for example, doctor's facilities, workplaces, shopping centers and so forth and additionally private structures in the nation aresettling on move down power frameworks. These move down control frameworks are normally diesel generators and some of the time more than one generator is introduced to take care of their power demand .With increasing expenses and natural mindfulness, a large number of these structures are choosing Solar PhotoVoltaic (SPV) frameworks as go down power so as to decrease their reliance on diesel generators. These SPV frameworks which change over daylight into power, are normally introduced on the current rooftop best space of structures to meet the base load necessity. Arun of the mill rooftop beat SPV framework comprises of all or some of the accompanying segments relying upon its sort: Photovoltaic modules Charge controllers Inverters Module mounting structures Departure switchyard Wires Metering framework Aside from these segments, an essential pre requisiteis accessibility of sans shadow rooftop best space. Least shadow free territory required to introduce a common 1kW framework on housetop is around 30 sq. m. There are two sorts are such rooftop beat SPV frameworks framework free frameworks and matrix associated frameworks. Lattice free frameworks accompany either with or without battery move down. Batteries are utilized to store the abundance power produced amid the day to be utilized around evening time or when inadequate sun oriented power is produced because of overcast cover and so forth. Given underneath is arun of the mill delineation of battery go down sunlight based rooftop beat framework. Batteries are regularly not decided on as - they are costly requiring high speculation furthermore they have to be intermittently supplanted. Thus, contingent upon the size of the framework and its necessity, a building picks for a battery move down framework or without battery reinforcement. In the second case, the framework is by and large estimated with the end goal that power created amid the day from this SPV is used to meet its energy prerequisite and the night time or when there is insufficient power generated, electricity is drawn from the grid or diesel generator.

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II. LITERATURE SURVEY

In previous chapter we have seen the introduction about the overall system for generating the energy from the sun by using solar panel in which the overall working and idea behind the design system was given. In this chapter we will see some of the referred IEEE reference papers. In which information of different models, system, technologies previously used for generating energy from the sun was done through this different models is shown. It also contains the different approach which was used in utilizing solar energy. Luis Arnedoet. al [1] has proposed a work, The aim of this work is the development of a solar photovoltaic generation system based on a standard power cell for microgrid applications. The proposed system is capable of providing security of supply by delivering uninterrupted power to critical loads in standalone operation and transitioning seamlessly between stand alone and grid connected mode. To mitigate the effect of variability of the generation and load demand a state of the art 20kWh lithiumion battery is used to balance the power flow in the system. This paper presents description of the hardware, proposed controls strategies and simulation models of the system. In addition to the energy savings that renewable energy may provide. There is a strong need to increase energy security. DoD energy security means having assured access to reliable supplies of energy and the ability to protect and deliver sufficient energy to meet operational needs. In this regard renewable energy and energy storage elements play a fundamental roles enabling diversification of standby energy sources today dominated by diesel generators. Main challenge for renewable energy sources to be able to fill the gap in terms of reliable supplies of energy is the un predictable nature of the energy source such as solar and wind and the stochastic nature of the load. However, with the introduction of new energy storage elements with higher energy storage capacity such as super-capacitors, lithium ion batteries and flow batteries clearly opens the possibility to deploy renewable energy sources able to work in standalone mode and seamlessly transition from grid disconnected to grid connected mode of operation . The aim of this paper is the development of a solar photovoltaic micro-source with Lithium-Ion battery. The main advantage of this system is capable of providing security of supply by delivering uninterrupted power to critical loads in standalone operation. But the one of the drawback of the system is seamlessly transition from off-grid to grid. Yu-Jen Liu et. al. [2] has proposed a Photovoltaic inverter, that is in charge of electric power conversion, is a critical component used in solar photovoltaic power systems. Many concerns are focused on the operation of photovoltaic inverter due to the worse designing may cause the terrible influences on safety, performance and grid interconnection characteristics of solar photovoltaic power systems. IEEE SCC21 provides a uniform standard, known as IEEE 1547 standard, for interconnection considerations of distributed resources with electric power systems. The standard focuses on the technical specifications and includes general principles, response to abnormal conditions, power quality, islanding, and test instructions and requirements for design, production, installation evaluation, commissioning, and periodic tests.This paper gives a representation of an automatized PVI interconnection test system based on IEEE 1547 standard.The IEEE 1547 series of standards present the technical requirements that recommend the DER interconnection products should be met before enter to the market. These standards also play an important role for many countries to develop smart grid techniques since lots of interconnection DER systems are included. The proposed PVI interconnection test system mainly includes DC power source, equipment under test (EUT), AC power source, RLC load, data acquisition, monitoring and analysis system. It is an automation test system and maximum test capacity is up to 30 kW. The main advantage of this system is that it can give maximum Input power of 4700 W and nominal DC voltage upto 360 -400 V i.e. maximum Input voltage. But the disadvantage is that IEEE 1547 standard series present guidelines to describe the interconnection requirements. Solar inverters are designed specifically to handle photovoltaic (PV) panels, to efficiently extract the most amount of power, and to transform it properly so that it can be injected into the grid. The singularities of the application allow for opportunities that can be exploited for better performance. Inverters for PV applications are designed to operate at very low voltage variations, almost at a fixed frequency, and with a power factor usually greater than 0.8. While keeping these inverter-specific characteristics in mind, a new topology is proposed. In this work, such new topology provides operational characteristics close to a 5-level topology. This achievement is accomplished by adding just a few more power-electronic components required for a 3-level topology. A complete 3-phase system is designed and simulated. Its good performance is demonstrated, and its benefits and limitations are pointed out. Furthermore the feasibility of this new topology is also explored and verified by implementing a low-power inverter system with the proposed topology. The more outstanding of those characteristics are that PV inverters are designed to operate at very low voltage variation, almost fixed frequency, and with a power factor usually greater than 0.8. These special characteristics present the opportunity to elaborate a

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specialized inverter that meets the requirements of being low-cost while maintaining very high performance. There are two main complementary hard switching techniques that produce a sinusoidal wave with low-distortion: (1) by generating a high frequency PWM and (2) by instating the variation of DC voltage levels that the inverter produces (multilevel inverters). Increasing the switching frequency faces two key obstacles: the need for faster power devices such as wide-band gap devices that can be driven at such high frequencies, and for faster and more powerful microcontrollers in order to achieve proper active monitoring of complex systems such as solar inverters, thus leading to higher cost. The main advantage of this system is that A novel low cost topology that exhibits performance similar to a 5 level topology was simulated and experimentally validated. But the drawback is that the topology requires an extra circuit to balance the capacitors. A single full bridge DC-DC converter is proposed to balance the capacitors. This work is developed by Antonio Ginart1 et. al. [3]. Tai-Hung Wang Chen Liu et. al.[4] Has also presented a work on the design and implementation of a DSP-based grid-tied solar cascode-micro-inverter. The proposed solar inverter with maximum power point tracking (MPPT) function is connected with the A C grid by a cascode-circuit configuration. Due to the studied single-stage power conversion, high conversion efficiency, high MPPT accuracy and low harmonic distortion can be achieved. A 300W laboratory prototype was implemented and tested to verifY the feasibility of the proposed scheme. The renewable energy such as fuel cells, solar cells and wind power development has attracted worldwide attention. The development of related industries also is affected in future economic growth. The photovoltaic power systems which have been concerning on two major categories that the solar cell panels produce electricity rates and modules parallel backend grid systems. The solar modules produce electricity rate includes solar panels material improvements and maximum power point tracking. The back-end parallel is exploring on the efficiency of solar modules and harmonic circuit related improvements. Rui Wu et. al.[5] has proposed a work on IGBT, Reliability is one of the key issues for the application of Insulated Gate Bipolar Transistors (IGBTs) in power electronic converters. Many efforts have been devoted to the reduction of IGBT wear out failure induced by accumulated degradation and catastrophic failure triggered by single-event overstress. The wear out failure under field operation could be mitigated by scheduled maintenances based on lifetime prediction and condition monitoring. However, the catastrophic failure is difficult to be predicted and thus may lead to serious consequence of power electronic converters. To obtain a better understanding of catastrophic failure of IGBTs, the state-of-theart research on their failure behaviors and failure mechanisms is presented in this paper. Moreover, various fault-tolerant design methods, to prevent converter level malfunctions in the event of IGBT failure, are also reviewed. Insulated Gate Bipolar Transistors (IGBTs) are hybrid bipolarmetal-oxide semiconductor, which have the advantages of low on-state resistance, voltage control of the gate and wide safe operating area. IGBTs are also one of the most critical components as well as the widely used power devices in power electronic systems in the range above 1 kV and 1 kW. According to the survey, the most used power devices for industrial applications are IGBTs [4]. Therefore it is worth investigating IGBTs failure and exploring the solutions to improve the reliability of IGBT power electronic converters. Mohammed A. Elgendyet. al.[7] Has also developed an efficient, cost-effective maximum power point tracking (MPPT) algorithm is required to improve the energy utilization efficiency of low power photovoltaic (PV) systems. This paper presents an experimental evaluation of the incremental conductance MPPT algorithm when employed by a standalone PV pumping system, using an experimental installation comprised of a 1080-Wp photovoltaic array connected to a 1-kW permanent magnet dc motor-centrifugal pump set. Particular focus is given to the evaluation of the two commonly utilized implementation techniques: reference voltage perturbation and direct duty ratio perturbation. The influence of algorithm parameters on system behavior is investigated and the energy utilization efficiency is calculated for different weather conditions. The performance of the incremental conductance algorithm is compared to that of the commonly used perturb and observe MPPT algorithm and the various advantages and drawbacks of each technique are identified. Another very popular hill-climbing MPPT algorithm is the incremental conductance (INC) algorithm . This MPPT algorithm is based on the fact that the powervoltage curve of a PV generator at constant solar irradiance and cell temperature levels has normally only one MPP . At this MPP point, the derivative of the power with respect to the voltage equals zero which means that the sum of the instantaneous conductance and the incremental conductance equals zero. The main advantage of this system is that the performance of the incremental conductance MPPT is good as compared to that of the commonly used Perturb observe MPPT algorithm. But the drawback of the system is System Dynamic irradiance.

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III. SYSTEM ARCHITECTURE

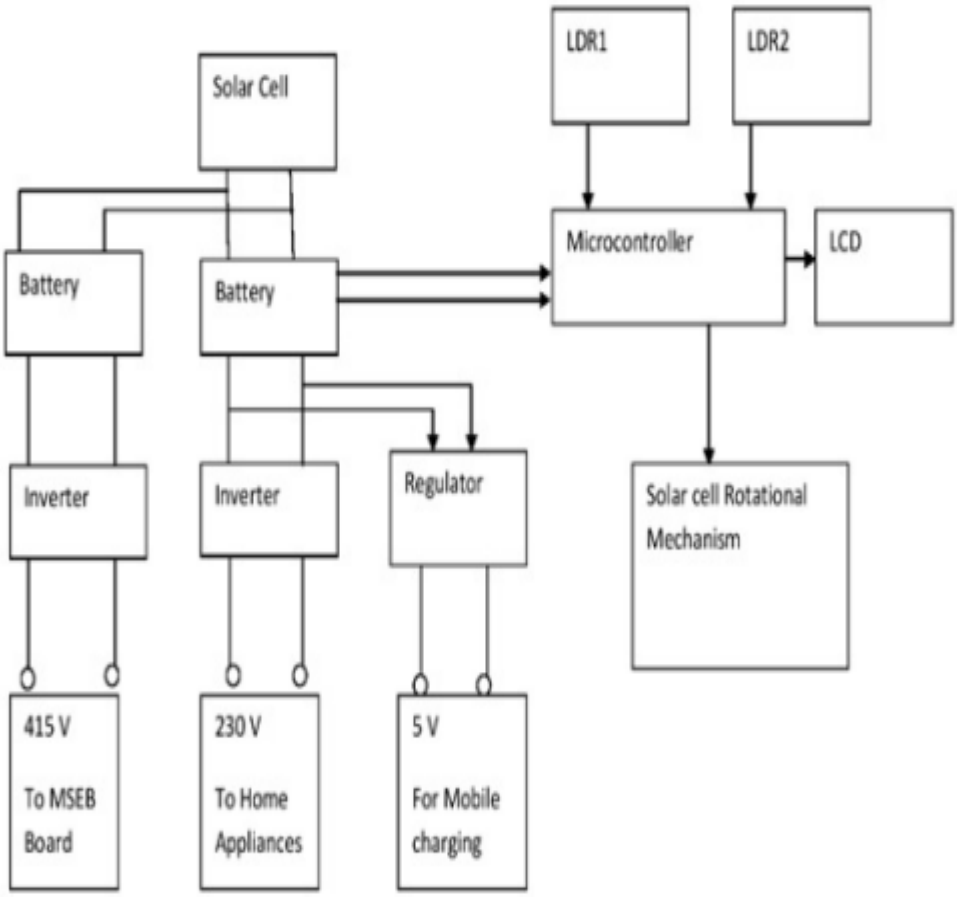

Fig. 1.System Architecture

We are going to use Bifacial solar cell so that wecan get the maximum radiation from the sun and produce more amount of power from the solar cell. In this project we are using two batteries. One Battery is for Home appliences and other is for MSEB Grid. One Inverter is for to change the solar cell DC voltage to 415 V AC for MSEB Grid and it can produce 50Hz frequency and other is for 230 V for Home and to produce 50Hz frequency. Amount of supply we are getting from inverter is processed to the MOSFET for amplifying the current to some specified range so as to get the required values of the voltage from the transformer. Two step up transformer are used in which one gives 230v and another gives 410v. For Charging of Mobile we require 5 V DC output. Here we are used 7805 regulator which gives 5 V as output. LDR1 LDR2 is used to detect the position of the Sun. LDR convert the light intensity into Resistance and then by signal conditioning we have convertd change in resistance into change in voltage. This voltage is given to the Microcontroller PIC16F887. D293D motor driver is used for rotating the solar panel in bidirectional way, this motor driver is dual h bridge which uses PWM to perform the task and rotate the motors. Then by detecting this analog input for LDR1 and LDR2 motor at Solar cell Rotational Mechanism is rotated. The Voltage and Current at Solar cell is calculated by Microcontroller and then it is displayed on LCD.

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IV. FLOWCHART OF THE SYSTEM

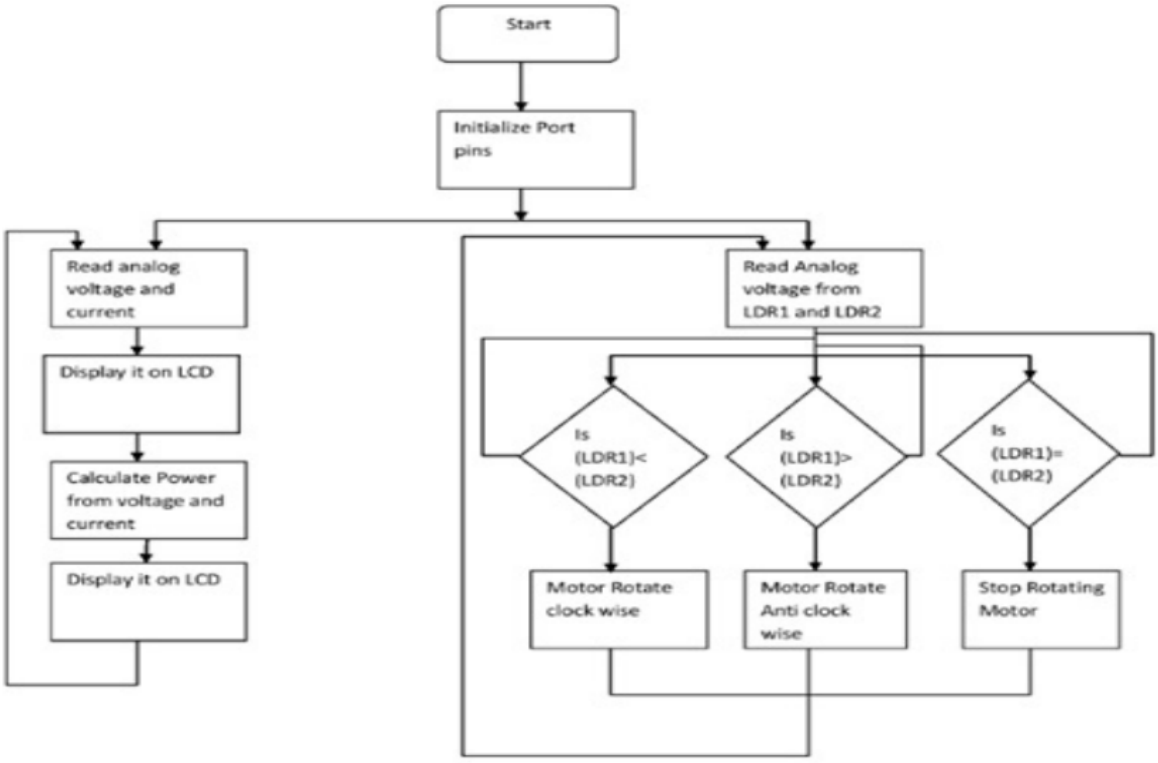

Fig.2. Flow of System

V. EXPERIMENTATION RESULTS

Figure shows developed hardware of proposed system which includes solar cell which receives radiations from the sun, we can also use bi-facial solar panel which can absorb more radiation. After absorbing radiation, it can be used as a source of energy and received energy will be transferred to battery of 12v which act as inverter in the proposed system . Simple PWM dc to ac voltage inverter circuit based on IC SG 3524 is used in the system . The SG3524 IC chips is a fixed frequency PWM (Pulse Width Modulation) voltage regulator control circuit, with in different outputs for single ended or push pull applications. The SG3524 IC integrated circuit has all the functions necessary for the production of a regulating power supply, which enables us to have constant frequency 50hz to all the section of entire circuit. The current coming From Inverter goes to MOSFET which amplify the current to some specified range so as to get enough source of energy to utilize the transformer. In the proposed system, two step up transformer are being used for the two different purposes. One transformer gives the voltage of 230V, whereas, another transformer is capable of providing 415V. Both the purposes have their different application of Home Appliances and another one gives 415V for MSEB purpose.

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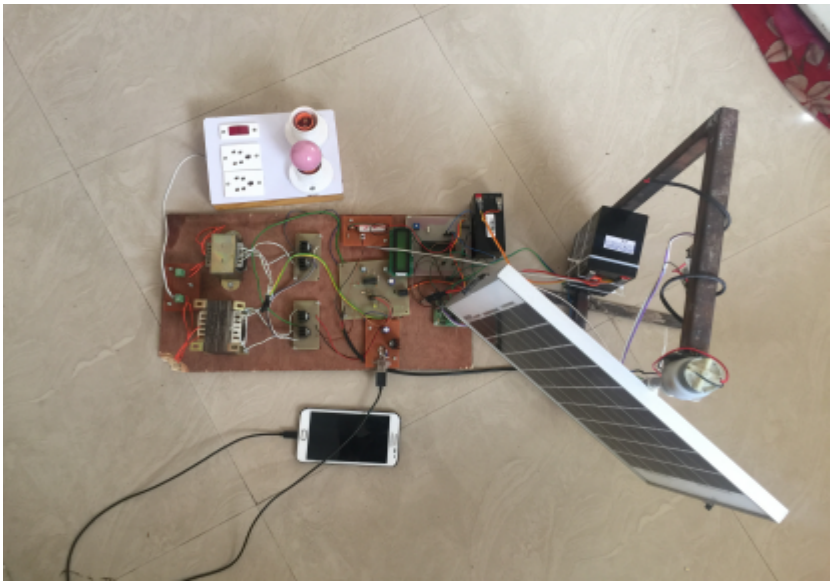

Fig.3.Developed Hardware.

Working of the developed hardware is starts from getting the supply of 230v from transformer to the application of home appliances like tubelight, bulb, fan, cooler and tv etc. For mobile charging purpose we are getting constant 5v by using voltage regular in the circuitry, the values of power are being displayed on the LCD which comes from the solar panel, microcontroller PIC 16F887 is programmed to monitor the values on LCD and also one motor is used to change the direction of solar panel for getting maximum amount of radiation. Two limiting switches are also used in the system to change the direction of solar panel accordingly with the coming radiation of Sun.

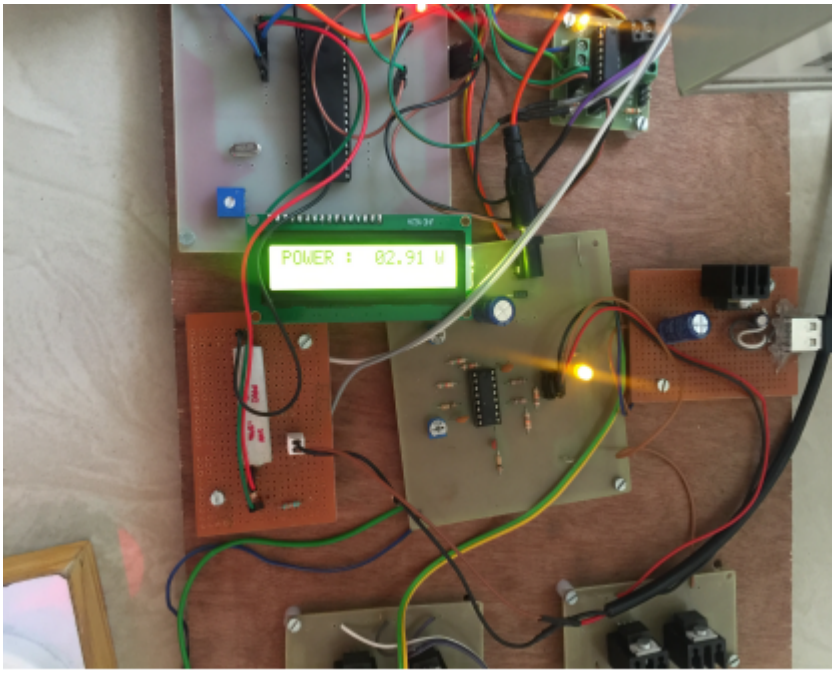

Fig.4. Calculated Power on LCD.

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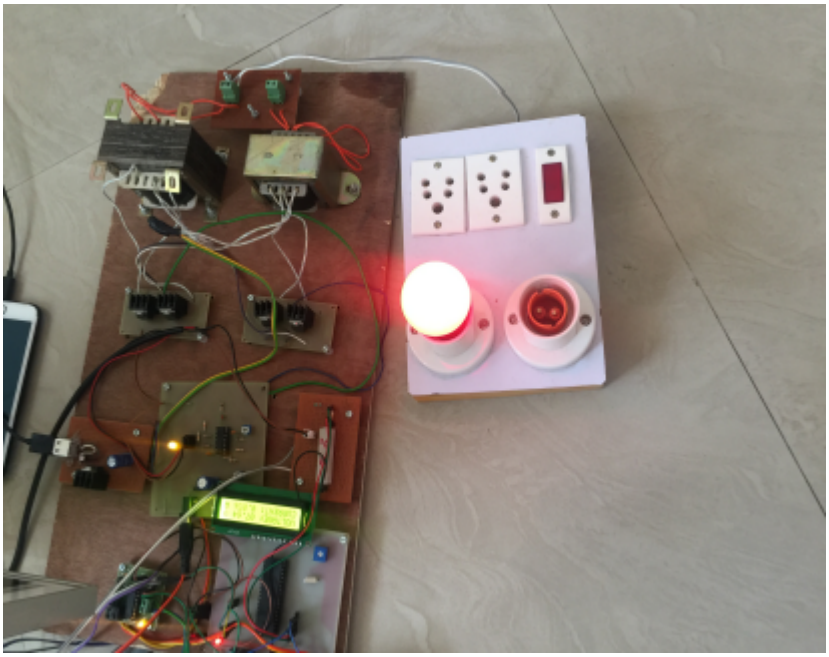

Fig.5.Application of Home Appliances

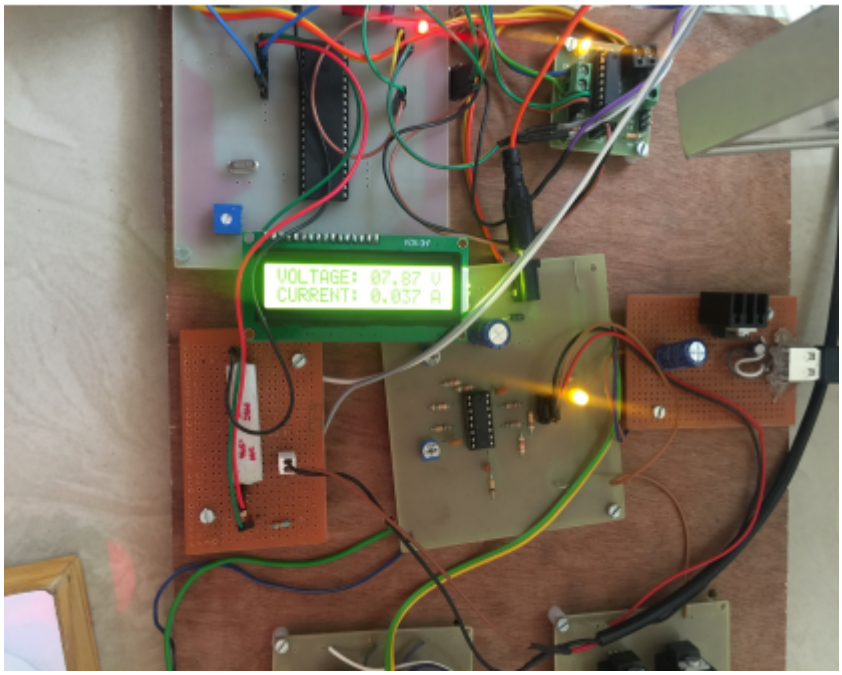

Fig.6. Calculated Voltage and Current on LCD.

VI. CONCLUSION

In the grid interactive system, the solar power which may be available in excess of the demand during period of high sunshine is fed to the grid and is utilized elsewhere. This also improves the grid voltage and power factor. The grid

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interactive system having some storage for the energy, obtained from PV, can compensate the voltage of a pure, grid connected system. The system has been designed to supply continuous power to a dedicated local load with the power to the load carrying from the solar array, grid, or battery bank in the order of preference. Satisfactory steady state performance experienced from the system in terms of energy conservation indicates that the grid interactive PV system is Economically Viable and Technically Feasible for Grid Interaction of Solar PV Generation. This is an innovative and a promising option for large scale penetration of this technology will be helpful to alleviate the dependence on grid.

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