SMART SOLAR INVERTER

[1]Mayank Gulati, [2]Ruchika Doda
[1]Student, [2]Assistant Professor
[1]Department of Electrical Engineering
[2]Department of Electrical and Communication Engineering
Mahaveer Swami Institute of Technology, Sonipat, India

ABSTRACT: The term solar smart inverter has become a buzz word in the electronics industry which is a blending of multilevel inverter, solar tracking and solar charging. Inverters are predominantly classified as single level inverters and multilevel inverters. Minimum harmonic distortion, reduced EMI/RFI generation is the major advantages of multilevel inverters as compared to single level inverters. Multilevel inverters can operate on various voltage levels. Multipurpose applications, such as active power filters, machine drives for sinusoidal and trapezoidal current applications can be realized by multi-stage inverter. By incorporating pulse-width modulation (PWM) control, within the inverters we can control the gain of inverters more effectively. One of the most forthright methods of describing voltage source modulation for multilevel inverter is carrier based PWM schemes that can be conceived by the intersection of a modulating signal with triangular carrier waveforms. In this paper, we are designing a Solar Multilevel Pulse Width Modulator inverter using microcontroller and cascade H bridge topology which increases the efficiency and reliability of the system. We are also assimilating Maximum Power Point Tracking for higher efficiency. The solar panel will track the sun from dusk to dawn to get maximum power of sunlight to the solar panel.

Keywords: Solar Panel, Micro-Controller, Dry Battery, Sensor, Inverter, Led Bulb, 8-Bit Display Device

1. INTRODUCTION

The term ―smart inverter‖ has become a buzzword in the industry, but what does it really mean? For an inverter to be considered smart, it must have a digital architecture, bidirectional communications capability and robust software infrastructure. The system begins with reliable, rugged and efficient silicon-centric hardware, which can be controlled by a scalable software platform incorporating a sophisticated performance monitoring capability. A smart inverter must be adaptive and able to send and receive messages quickly, as well as share granular data with the owner, utility and other stakeholders. Such systems allow installers and service technicians to diagnose operational and maintenance issues including predicting possible inverter or module problems and remotely upgrade certain parameters in moments. These intelligent-power-electronics devices must also include stout application-programming-interface (API) functionality that provides fleet owners and other partners a way to tie in their own software to create powerful enterprise-level tools. (An API is a set of programming instructions for accessing web software or a web-based tool. When a company releases its API, users are able to have their own software interact with the com

2. METHODS AND MATERIAL

PWM Technology

Pulse-width modulation (PWM), or pulse-duration modulation (PDM), is a modulation technique used to encode a message into a pulsing signal. Although this modulation technique can be used to encode information for transmission, its main use is to allow the control of the power supplied to electrical devices, especially to inertial loads such as motors. In addition, PWM is one of the two principal algorithms used in photovoltaic solar battery chargers, the other being maximum power point tracking.
The average value of voltage (and current) fed to the load is controlled by turning the switch between supply and load on and off at a fast rate. The longer the switch is on compared to the off periods, the higher the total power supplied to the load. The PWM switching frequency has to be much higher than what would affect the load (the device that uses the power), which is to say that the resultant waveform perceived by the load must be as smooth as possible. Typically switching has to be done several times a minute in an electric stove, 120 Hz in a lamp dimmer, from few kilohertz (kHz) to tens of kHz for a motor drive and well into the tens or hundreds of kHz in audio amplifiers and computer power supplies.

The term duty cycle describes the proportion of 'on' time to the regular interval or 'period' of time; a low duty cycle corresponds to low power, because the power is off for most of the time. Duty cycle is expressed in percent, 100% being fully on. The main advantage of PWM is that power loss in the switching devices is very low. When a switch is off there is practically no current, and when it is on and power is being transferred to the load, there is almost no voltage drop across the switch. Power loss, being the product of voltage and current, is thus in both cases close to zero. PWM also works well with digital controls, which, because of their on/off nature, can easily set the needed duty cycle. PWM has also been used in certain communication systems where its duty cycle has been used to convey information over a communications channel.

IR Sensor

An infrared sensor is an electronic device that emits in order to sense some aspects of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. These types of sensors measures only infrared radiation, rather than emitting it that is called as a passive IR sensor. Usually in the infrared spectrum, all the objects radiate some form of thermal radiations. These types of radiations are invisible to our eyes that can be detected by an infrared sensor. The emitter is simply an IR LED (Light Emitting Diode) and the detector is simply an IR photodiode which is sensitive to IR light of the same wavelength as that emitted by the IR LED. When IR light falls on the photodiode, the resistances and these output voltages, change in proportion to the magnitude of the IR light received. An infrared sensor circuit is one of the basic and popular sensor modules in electronic devices. This sensor is analogous to human's visionary senses, which can be used to detect obstacles and it is one of the common applications in real time. This circuit comprises of the following components

- LM358 IC 2 IR transmitter and receiver pair
- Resistors of the range of kilo ohms.
- Variable resistors
- LED (Light Emitting Diode)

Power Saving

The objective of this technique is to make a microcontroller based model to count number of persons visiting particular room and accordingly light up the room. Here we can use IR sensor and can know present number of persons. In today's world, there is a continuous need for automatic appliances with the increase in standard of living; there is a sense of urgency for developing circuits that would ease the complexity of life.

Also if at all one wants to know the number of people present in room so as not to have congestion. This circuit proves to be helpful. This technique Light Automation using Bidirectional Visitor counter using Microcontroller is a reliable circuit that takes over the task of controlling the room lights as well us counting number of persons/ visitors in the room very accurately. When somebody enters into the room then the counter is incremented by one. Over here we have extended the project by using a Temperature Sensor LM35 which will be used to monitor the room temperature so if the temperature of the room is high the fan will turn ON. If there is no one in the room the room lights automatically Turn OFF. Moreover the total number of persons inside the room is also displayed on the LCD.

The microcontroller does the above job. It receives the signals from the sensors, and this signal is operated under the control of software which is stored in ROM. Microcontroller 89s52 continuously monitor the Infrared Receivers. When any object pass through the IR Receiver's then the IR Rays falling on the receiver are obstructed, this obstruction is sensed by the Microcontroller.

Solar Panel (Flat Plate Collector)

A typical flat plate collector is a metal box with a glass or plastic cover (glazing) on top and a dark coloured absorber plate on the bottom the sides and bottom of the collector are usually insulated to minimize heat loss**.**

Sunlight passes through the glazing and strikes the absorber plate, which heats up, changing solar energy into heat energy. The heat is transferred to liquid passing through pipes attached to the absorber plate. Absorber plates are commonly painted with "selective coatings," which absorb and retain heat better than ordinary black paint. Absorber plates are usually made of metal—typically copper or aluminium because the metal is a good heat conductor. Copper is more expensive, but is a better conductor and less prone to corrosion than aluminum. In locations with average available solar energy, flat plate collectors are sized approximately one-half- to one-square foot per gallon of one-day's hot water use.

Microcontroller Circuit (AT89S52)

The AT89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory. The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the industry-standard 80C51 instruction set and pinout. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer. By combining versatile 8-bit CPU with in-system programmable Flash on a monolithic chip, the Atmel AT89S52 is a powerful microcontroller which provides a highly-flexible and cost-effective solution to many embedded control applications. The AT89S52 provides the following standard features: 8K bytes of Flash, 256 bytes of RAM, 32 I/O lines, Watchdog timer, two data pointers, three 16-bit timer/counters, a six-vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator, and clock circuitry. In addition, the AT89S52 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes. The Idle Mode stops the CPU while allowing the RAM, timer/counters, serial port, and

interrupt system to continue functioning. The Power-down mode saves the RAM contents but freezes the oscillator, disabling all other chip functions until the next interrupt or hardware reset.

The circuit diagram of microcontroller circuit diagram is shown in figure.

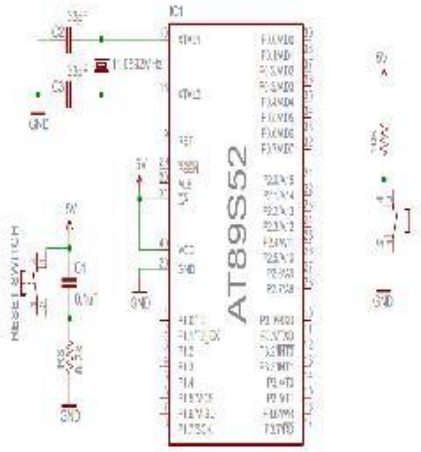

Figure. Circuit diagram of microcontroller circuit

Dry cell

A **dry cell** is a type of electric battery, commonly used for portable electrical devices. It was developed in 1886 by the German scientist Carl Gassner, after development of wet zinc-carbon batteries by Georges Leclanché in 1866. The modern version was developed by Japanese Yai Sakizo in 1887.

A dry cell uses a paste electrolyte, with only enough moisture to allow current to flow. Unlike a wet cell, a dry cell can operate in any orientation without spilling, as it contains no free liquid, making it suitable for portable equipment. By comparison, the first wet cells were typically fragile glass containers with lead rods hanging from the open top and needed careful handling to avoid spillage. Lead–acid batteries did not achieve the safety and portability of the dry cell until the development of the gel battery. Wet cells have continued to be used for high-drain applications, such as starting internal combustion engines, because inhibiting the electrolyte flow tends to reduce the current capability.

A common dry cell is the zinc-carbon cell, sometimes called the dry Leclanché cell, with a nominal voltage of 1.5 volts, the same as the alkaline cell (since both use the same zinc– manganese dioxide combination).

A standard dry cell comprises a zinc anode, usually in the form of a cylindrical pot, with a carbon cathode in the form of a central rod. The electrolyte is ammonium chloride in the form of a paste next to the zinc anode. The remaining space between the electrolyte and carbon cathode is taken up by a second paste consisting of ammonium chloride and manganese dioxide, the latter acting as a depolariser. In some designs, often marketed as "heavy duty", the ammonium chloride is replaced with zinc chloride.

Dry cell types

- Primary cell
  - Zinc-carbon cell
  - Alkaline cell
  - Lithium cell
  - Mercury cell
  - Silver oxide cell
- Secondary cell
  - Nickel-cadmium cell
  - Lithium ion cell
  - Nickel metal hydride cell

Primary cells are not rechargeable and are generally disposed of after the cell's internal reaction has consumed the reactive starting chemicals.

Secondary cells are rechargeable, and may be reused multiple time

3. CONCLUSION AND FUTURE ENHANCEMENT

Solar inverter are usually about 95% efficient inverter play a significant role in providing alternate current supplies at the times of crucial power requirement the primary use of solar inverter is to convert direct current to alternating current through an electrical switching process. This paper basically uses the non-conventional energy resources and the presence of the IR sensors also advances the solar inverter to smart form. Basically the presence of IR sensor saves the power and that can be further utilized in future.

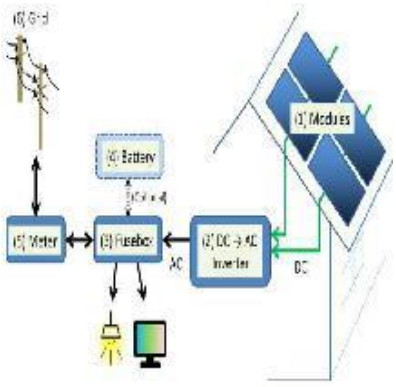

Figure. Block diagram of Future Enhancement

India, a fast-growing economy, with more than 1 billion people, confronted with the huge energy needs. the country is fifth in the world for the production and

consumption of electricity. Electricity production has increased over the years, but we cannot deny the fact that the population is also increasing. Generated from mostly coal (53%) of and, as predicted, the country's coal reserves will not last beyond 2040-50. More than 72% of the population living in rural areas and half of villages without electricity. The time has come when we should focus on energy efficiency, conservation and renewable energy. To meet this growing demand, solar energy is the best form of energy to meet the energy needs of India and reduce energy demand and supply. Solar power in India has huge potential to generate solar energy. The geographical location of the country is in their interests to generate solar energy. The reason that India is a tropical country and receives solar radiation almost throughout the year that is 3000 hours of sunshine. That amounts to more than 5000 billion kWh. Solar energy is inexhaustible. In most energy deficient countries like India, where electricity is expensive, solar energy is the best an alternative means to generate electricity. The extra power generated can be attached to grid directly during future enhancement

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