Solar Refrigerator for Domestic Use

Aditya Bhange[1], Purva Karwade[2], Payal Fating[3], Rakhi Meshram[4], Aman Kamble[5], Prof. (Mrs.) A. Sonaliker[6]

Student, Department of Electrical (Electronics & Power) Engineering, PCE, Nagpur, Maharashtra, India[1-5]

Professor, Department of Electrical (Electronics & Power) Engineering, PCE, Nagpur, Maharashtra, India[6]

Abstract: The presentation is about a solar powered refrigerator as a source of energy. Solar power is chosen as the alternative energy source. The demand of energy is increasing as the population and economy is growing. The use of fossil fuels will further deteriorate the environment. One of the growing industry is refrigeration and air conditioning due to the change in lifestyle and also essential for the increase shell life of fruits vegetables and to store certain medicines and vaccines. In this project we introduce the portable refrigerator using peltier module with solar energy as supply which overcomes the disadvantages of existing refrigerator with increase in pollution and environment.

Keywords: eco-friendly, portable, cheaper

I.INTRODUCTION

In India at present time most of the population do not have electricity in their homes. According to new analysis in Jan 20 2018 International Energy Agency (IEA) 1.1 billion people across the world do not have electricity in their homes. One solution is a RAPS (Remote Area Power Supply) using an alternative form of energy. A popular renewable energy resource is a PV (photo Voltaic) panel due to its 12VDC Compatibility with automobile appliances. The high cost of PV panels2 (R1112 fora 40W PV panel), necessitates a small installation (40W – 10W) which usually provides only enough energy for lighting, a radio and a black and white T.V. No cooking, heating, air-conditioning or electrical geyser (all high power consumption equipment) can be accommodated due to the low power output of the PV panels (although such a high power output is possible, it would be very expensive). For PV systems to be accepted, it should provide a fair degree of compatibility with household appliances. Therefore either the PV system should be adapted to provide220VAC (Alternating Current) using an inverter, or appliances should be designed to operate at 12VDC (Direct Current).The study found that once households received electricity, they still relied on multiple fuel use for cooking, heating etc. The electrical energy is usually used for lighting, because of its low energy consumption and the substantial increase it makes to living standards. In these houses, the most sought after appliances are a television, radio and (despite the cost) refrigerators.

II.PROPOSED WORK
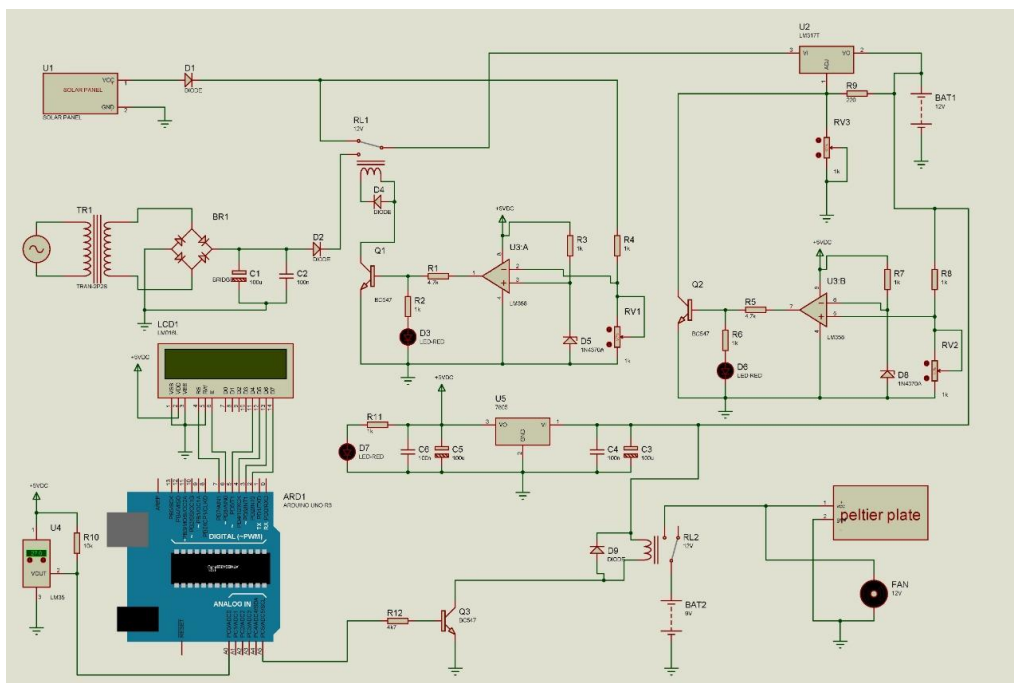
In this project, microcontroller (arduino UNO) is used for controlling the whole process. LCD is used for displaying the temperature in degree Celsius. This LCD D is directly connected to the microcontroller (aurdino).The Solar panel is connected to the battery through diode D1. This diode (D1) protects the solar panel from reverse current of the battery. Here a comparator circuit is introduced, one terminal of the comparator circuit is connected to the solar panel and other to the SPDT relay. The grid voltage is around 230 volt therefore a step down transformer (TR1) is used and 230 volt is step down to 12 volts. Later it is converted into DC source by using bridge type rectifier (BR1) having two capacitive (C1, C2) type filters in parallel to each other. The rectifier is connected to the SPDT relay through a diode (D2). This diode protects circuit from reverse current. The SPDT relay (R1) is responsible for switching between solar and grid energy. One terminal of the relay is connected to the battery through LM317 IC whereas the other end of the relay is connected to the rectifier and the terminal is grounded through a transistor which is connected to the comparator circuit. A diode D4 is connected in the relay which is called as a freewheeling diode. This diode removes the extra magnetic field which can affect the circuit.

In the circuit, when the voltage at negative terminal is more than the positive terminal then the output will be 0 volts since pin 5 is grounded. Hence, the LED light won't glow and the transistor will not start. If the voltage at positive terminal of the operational amplifier is more than that of the negative terminal this should give 5 volts as an as an output which will make the LED light glow and transistor will be on this will lead relay to switch from solar supply to grid supply (230V).The LM317 is used for adjusting voltage at 12 volts. Whenever the voltage rises above 12 volts the LM317 IC adjust it back to 12 volts. This IC consists of 3 terminals Pin 1 - voltage in Pin 2 - voltage out Pin 3 -adjustment pin Here, pin 1 is connected to SPDT relay, pin 2 is connected to the battery The output supply form the battery is monitored by the resistor R9 which is connected through the transistor Q2The output from the battery is connected to the positive terminal of the operational amplifier i.e. pin 9 through voltage divider. The RV2 is a variable resistor it is adjusted. The negative terminal is connected through diode D8.If the negative terminal has more voltage than positive terminal then the output would be zero and transistor will not turn ON. If the positive terminal has more voltage than that of negative terminal then the output will be 5 volts. This will turn the transistor ON and it. When the transistor turns ON the output voltage would flow towards ground hence at adjustment pin there will be zero voltage. Hence, the LM317 IC will stop the supply to the battery.

III.IMPLEMENTATION DETAILS

Solar Panel

A solar panel converts sunlight into an electric current or heat used to provide electricity for home or building. Solar panel used are polycrystalline. Polycrystalline solar panels are made from silicon they are also referred to as "multi-crystalline" 12 watt solar panel.

Battery

A battery is a device consisting of one or more electrochemical cells with external connections for powering electrical devices such as flashlights, mobile phones, and electric cars. When a battery is supplying electric power, its positive terminal is the cathode and its negative terminal is the anode. The terminal marked negative is the source of electrons that will flow through an external electric circuit to the positive terminal. When a battery is connected to an external electric load, a redox reaction converts high-energy reactants to lower-energy products, and the free-energy sterm "battery" specifically referred to a device composed of multiple cells, however the usage has evolved to include devices composed of a single cell

Relay

The Single Pole Double Throw SPDT (30A) relay is quite useful in certain applications because of its internal configuration. It has one common terminal and 2 contacts in 2 different configurations: one can be Normally Closed and the other one is opened or it can be Normally Open and the other one closed. So basically you can see the SPDT relay as a way of switching between 2 circuits: when there is no voltage applied to the coil one circuit "receives" current, the other one doesn't and when the coil gets energized the opposite is happening.

Arduino

The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital. Input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic. Resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a

computer with a USB cable or power it with AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial Converter. ATMEGA328P is a 28 pin chip. Many pins of the chip here have more than one function. We will describe functions of each pin in below table

Peltier Plate

A Peltier cooler, heater, or thermoelectric heat pump is a solid-state active heat pump which transfers heat from one side of the device to the other, with consumption of electrical energy, depending on the direction of the current. Thermoelectric cooling uses the Peltier effect to create a heat flux at the junction of two different types of materials. A Peltier cooler, heater, or thermoelectric heat pump is a solid-state active heat pump which transfers heat from one side of the device to the other, with consumption of electrical energy, depending on the direction of the current. Such an instrument is also called a Peltier device, Peltier heat pump, solid state refrigerator, or thermoelectric cooler (TEC). It can be used either for heating or for cooling, although in practice the main application is cooling. It can also be used as a temperature controller that either heats or cools.

V.CONCLUSION

The Solar Refrigerator was successfully prepared without using any refrigerants but by using peltier effect. There are several different types of cooling devices available to remove the heat from industrial enclosures, but as the technology advances, thermoelectric cooling is emerging as a truly viable method that can be advantageous in the handling of certain small-to-medium applications. As the efficiency and effectiveness of thermoelectric cooling steadily increases, the benefits that it provides including self-contained, solid-state construction that eliminates the need for refrigerants or connections to chilled water supplies, superior flexibility and reduced maintenance costs through higher reliability will increase. As well as it can use in ambulance for storing medical equipment's, can use in remote area for storing.

REFERENCES

[1]. Ray Dabengwa on Prepayment 1994. Prepayment Electricity, Jan/Feb,15.
[2]. The rlitail prices as suggested by Helios LID (Pty), 57 Adrian Crescent, Gateway Industrial Park Verwoerdburg.
[3].ArticleintheSundayTimes-BusinessTimessection,22January1995,pg3.
[4].Minus40,P.O.Box1492,Dassenberg,7350.Tel:0226-73033.
[5]..Edesa,27PowerStreet,Germiston,Johannesburg,2000.
[6].Hyperama.TygerValley,CapeTown.
[7].Minus40,P.O.Box1492,Dassenberg,7350.Tel:0226-73033.
[8].Edesa,27PowerStreet,Germiston,Johannesburg,2000.
[9].TheColemanCompany,INCWichita,Kansas67219,U.S.A.
[10]. Peterson, RG. 1992. Thermoelectric Cooling for Microwave Transmitters Located at Remote Sites. Cape Technikon: School for Mechanical Engineering, pg 177.