International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 05 Issue: 04 | Apr-2018 www.irjet.net p-ISSN: 2395-0072

Solar Energy Feed Air Cooler

Abhishek Limaye[1], Rashmi Patil[2], Shyamal Bhamre[3], Mrunal Annadate[4]

[1,2,3] UG Students, Department of E&TC, MITCOE, SPPU, Pune, India.
[4]Assistant Professor, Department of E&TC, MITCOE, SPPU, Pune, India.

Abstract - *Energy saving mechanism is the reason behind this project that led to design, develop and build a new solar energy feed air cooler unit with low power consumption. Solar Energy is stored in the battery and used to run the system. There is a deep discharge protection which will stop the cooler if the battery level goes below the threshold level; thereby maintaining the battery life. The present air cooling systems are dehumidifiers, evaporating coolers. But using these products require a source called electricity and the production of electricity is responsible for very hot and humid conditions like Global Warming. In very hot and extreme humid conditions there is need to feel relaxed, cool and comfortable so it has become one of the few needs and for this purpose the use of systems like air coolers and conditioners has increased rapidly. These systems are most of the time not suitable for villages due to long power cutting problems and high cost of products. Solar powered systems are considered as one of the systems having efficient energy. This technology can efficiently serve large loads and greatly improve indoor air quality by providing more ventilation while tightly controlling humidity.*

Key Words: Solar Energy, air cooler, battery, Global Warming, humidity.

1. INTRODUCTION

King Fahd University of Petroleum and Minerals of Dhahran, Saudi Arabia conducted a survey on solar air cooler [1]. They concluded that throughout the history of the human race, major advances in civilization have been measured by the increase in the rate of energy consumption. Today, energy consumption seems to be related to the life standard of the population and the degree of industrialization of the countries. However, the world today is facing unfavorable condition of atmospheric pollution on a much greater scale which has not been faced earlier in human history because of huge revolution in human use of fossil fuel in all activities.

To avoid this unfavorable impact, we need to reduce the harmful emission which resulting from burning fossil fuel as a source of energy. This can be achieved using renewable source of green energy. Among these energy sources, solar energy is the most important and attractive source because of its universal abundance and unlimited nature unlike many other renewable energy sources. The main characteristic of solar energy is continuous source being unending also it is an intermittent source during the day and night. Moreover, solar energy does not cause air pollution or affect the earth's surface as fossil fuel. Solar energy is easy to collect unlike the extraction of fossil fuels. Solar energy has great potential in the field of solar thermal system, because the cooling demand reaching its peak coincides with peak solar energy availability.

1.1 PRESENT SCENARIO

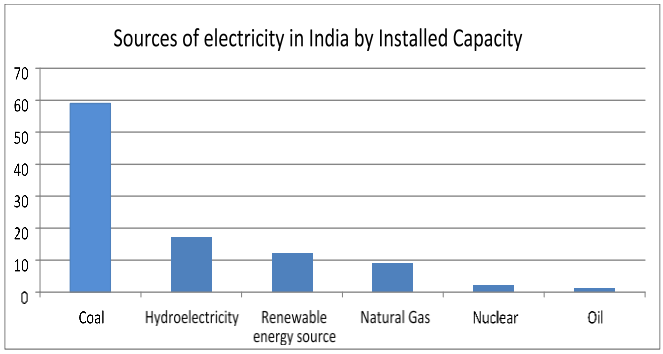

Fig -1: Production of electricity from different sources [5]

The production of electricity is in the long run responsible for very hot and humid conditions i.e. global warming. As in above shown graph it is clear that major quantity of electricity is produced by fossil fuel like coal. Fossil fuels mainly consist of radioactive materials, also uranium and thorium type of materials, which are exposed into the atmosphere, which contribute to smog and acid rain, emit carbon dioxide, which may contribute to climate change. In Figure 1 Production of electricity from different sources is shown. Also, there are very long power cut durations in villages and high cost of cooling products.

1.2 LITERATURE SURVEY

Author Vijaykumar Kalwa described in his "Modelling and Fabrication of Solar Powered Air Cooler" paper that in hot and humid conditions the need to feel relaxed and comfortable has become one of few needs and for this purpose utilization of systems like air conditioning and refrigeration has increased rapidly [2]. As solar systems considered as one of the moves towards most sustainable energy systems, considering solar-cooling systems present in villages would comprise of many attractive features.

Author Christopher Baldwin described in his paper on "A review of solar cooling technologies for residential applications in Canada" that in the last two decades, the demand for residential cooling has increased exponentially, creating a significant demand on the electrical grid during the summer months [3]. For the residential as well as commercial applications solar cooling technologies have been developed and implemented. Work conducted under

the International Energy Agency is described and a review of cooling installations both worldwide and Canada are discussed.

The paper "Review of International Solar Cooling Incentive Schemes" presents the insights from the incentive review and presents possible approaches to guide the future development of effective standards, guides and rating frameworks [4]. Each country has a range of government incentive and industry development programs, which have been designed with the intention of assisting the renewable energy and building energy efficiency industries.

2. BLOCK DIAGRAM

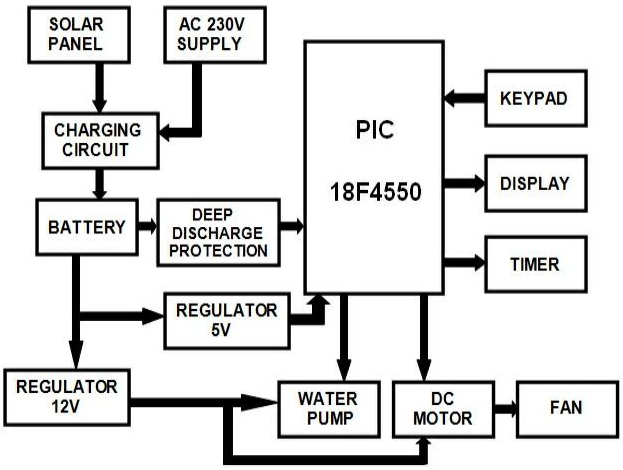

Fig -2: Block Diagram

Solar panel will take input in form of sunlight and convert it into electric energy which will be provided to charging circuit. In absence of sunlight the charging circuit will directly get connected to AC 230V supply. The output of solar panel is regulated to charge DC battery. We also used deep discharge protection which will stop the cooler if the battery level goes below the threshold level. We have used two different regulators since 5V is required by micro-controller and 12V is used by motor. Sometimes it happens that motor extracts more Voltage than 12V thus the controller doesn't get required 5V and it gets reset. We have used two relays to control fan and pump respectively. We are using the keypad for controlling the speed of cooler and to select the fan and motor and manual or auto mode and one display to show the temperature and the status of the fan speed.

Microcontroller used is PIC18F4550 [6].

Solar panel used is having maximum voltage of 19.0V and current of 2.05A with maximum power of 40W.

DC fan motor operates on 12V and 2A and consumes 24W power.

Water pump operates on 12V and 500mA and consumes 6W power.

Lithium battery is used which is a rechargeable dc battery having 12V and 7Ah ratings.

2.1 DEEP DISCARGE PROTECTION

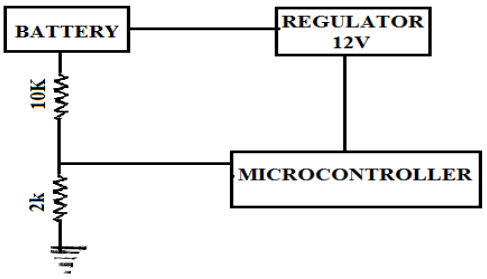

Fig -3: Deep Discharge Protection Circuit

The protection circuit consists of voltage divider network. It will sense the battery voltage, convert it into digital using ADC of micro- controller. Accordingly, micro-controller takes action to either start charging, stop charging or turn off the system.

2.2 WATER PUMP PROTECTION

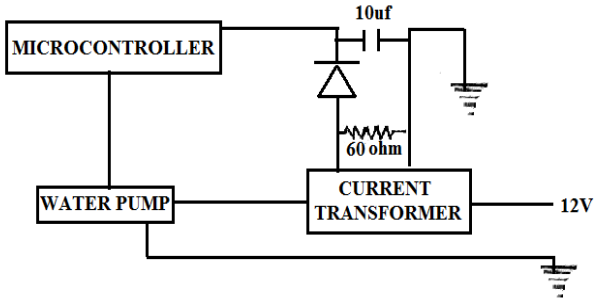

Fig -4: Water Pump Protection Circuit

We generally get 1A current when water level is much above the mini- mum level. As soon as the minimum level is reached, pressure increases and current drawn is approximately 1.5A. As soon as 1.5A is detected the pump is shut down and thus saves the pump from dry running and damage.

3. SOLAR ENERGY CONVERSION

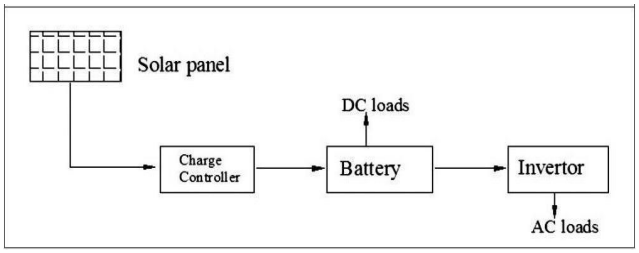

Fig -5: Solar Energy Conversion Process

This mainly consists of two sections. In first section there is solar energy conversion done by using battery and charge controller. The sunrays fall on a solar panel which converts solar energy into electrical energy by photoelectric effect. This electrical energy is stored in battery in the form of chemical energy. A protection circuitry is employed in between solar panel and battery which prevents overcharging. Deep discharge protection is used which can enhance battery performance or lifespan. In second section the stored energy can be used for DC loads or else can be converted to AC (alternate current) by the help of inverter. Types of solar energy are UV rays, cosmic energy and visible rays.

4. WORKING

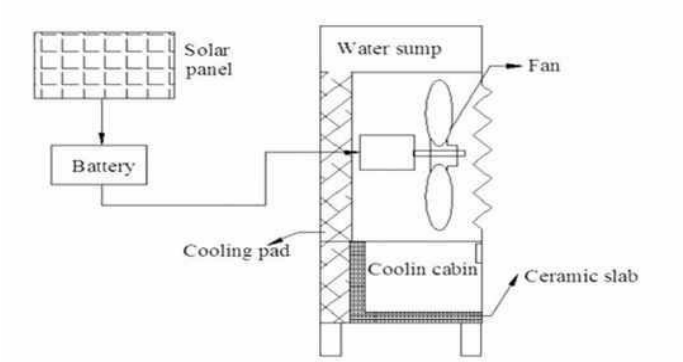

Fig -6: Solar Air Cooler with Cooling Cabin

This concept is driven by solar energy. The components involved in this concept are solar panel, battery, charge controller, blower, ceramic slabs and cooling pads. Solar panel is employed to convert sun light into electrical energy by means of photovoltaic effect. The generated electrical energy is supplied to the battery for storage through charge controller which prevents from power fluctuations. As DC blower is used for cooler, so it can be directly powered from the battery. This blower is surrounded by cooling pads through which we can provide continuous water supply. When the blower is switched on, blower absorbs atmospheric air into the cabin through the cooling pads, means at that time heat transfer occur between water and air, so that cool air enters into the room providing thermal comfort conditions.

5. CONCLUSION

We can conclude that this solar product appeals better and affordable by common people. This solar product perfectly suits for villages, schools and offices and thus an alternative to the power cut problems. It comprises of many attractive facilities such as water cooling, variable speed, timer and auto mode. In addition, the cooler also works on AC mains supply when the solar energy is not available. The cost of generation of power is very less and the source of power is free and available in plenty and there are no power interruptions.

REFERENCES

[1] Ayman Jamal Alazazmeh, "Review of solar cooling technologies", King Fahd University of Petroleum and Minerals of Dhahran, Saudi Arabia, 30th September 2015.

[2] Vijaykumar Kalwa and R Prakash, "Modelling and fabrication of solar power air cooler with cooling cabin for household food items", International Journal of Mechanical Engineering and Robotics Research, Vol. 3, No. 3, pp. 45-52, July 2014.

[3] Christopher Baldwin and Cynthia A. Cruickshank, "Review of solar cooling technologies for residential applications in Canada", Energy Procedia, Volume 30, 2012, Pages 495-504.

[4] Daniel Rowea and Stephen Whitea, "Review of International Solar Cooling Incentive Schemes", Energy Procedia, Volume 57, 2014, Pages 3160-3170.

[5] atlasgyan.blogspot.in/2015/12/electricityenergy-sector-of-india.html

[6] Muhammad Ali Mazidi, Rolin McKinlay, Danny Causey, "PIC Microcontroller and Embedded Systems: Using assembly and C for PIC-18", Pearson Education, 2008.

[7] Boonrit Prasartkaew and S. Kuma, "The quasi-steady state performance of a solar-biomass hybrid cooling system", The Second TSME International Conference on Mechanical Engineering, Krabi, 19-21 October 2011.

[8] J.M. Nash and A.J. Harstad, "Application of solar energy to air conditioning systems", NASA Technical Reports Server, retrieved November 26, 2016.

[9] Tanvir Ahmad, Sharmin Sobhan, Md. Faysal Nayan, "Basic Photovoltaic Principles and Methods", Journal of Power and Energy Engineering, Vol.4 No.3, March 31, 2016.