International Journal of Engineering Science Invention(IJESI)
ISSN (Online): 2319 – 6734, ISSN (Print): 2319 – 6726
www.ijesi.org ||Volume 6 Issue 12|| December 2017 || PP. 48-54

Heat Reduction in Car Cabin by Using Nonconventional Source of Energy

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Abstract: *The refrigerating units currently used in road transport vehicle are of Vapour Compression Refrigeration system (VCRS). This system utilizes power from the engine shaft as the input power to drive the compressor of the refrigeration system, hence the engine has to produce extra work to run the compressor of the refrigerating unit utilizing extra amount of fuel. In this project first aim of the project is to calculate the cooling load required for the 5 member passenger car. By considering all load factors like heat gain by window glass, roof, engine, persons, audio system. Second aim of the project, if car is parked in parking area in direct sunlight by closing all windows inside the temperature increases up to 60 to 70 Deg. But our comfort temperature is 23 Deg, for getting down that temperature it takes time and required lot of cooling load. For avoiding that problem in our project we are designing an exhaust fan worked by using solar energy. It sucks the inside hot air and it maintains outside air temperature. When car is parked in sunlight, fan will be controlled by thermostat which the temperature is set to out side air. By using this fan system we can reduce cooling load required for car while it is in parking. We can increase car mileage by this system. Software used in this project is Pro/Engineer for modeling, assembly, drafting.*

Keywords: *Photovoltaic module , Thermostats, Blower ,Solar panel ,Refrigeration system ,Solar System .*

Date of Submission: 11-12-2017 Date of acceptance: 22-12-2017

I. Introduction

Park a car under the sun for a couple of hours and it gets very hot. It would be too hot to get into. This is due to the design and the material of the car which is closed thus trapping hot air. Due to the hot air in car it is not comfortable to sit in the car. On top of that, many other problems also occur such as decreasing the lifespan of the car interior, dangerous to pets or human in car and wastage of air condition as the user would switch it to maximum level to get rid of the hot air. This project is done to find solution to overcome these problems. The main idea is to introduce the new HVAC system using thermoelectric couple which shall overcome all the disadvantages of existing HVAC system. If this system comes in present HVAC system, then revolution will occur in the automotive sector. With population and pollution increasing at an alarming rate TEC (thermoelectric couple) system have come to rescue as these are environment friendly, compact and affordable.

Conventional compressor run cooling devices have many drawbacks pertaining to energy efficiency and the use of CFC refrigerants. Both these factors indirectly point to the impending scenario of global warming. As most of the electricity generation relies on the coal power plants, which add greenhouse gases to the atmosphere is the major cause of global warming. Although researches are going on, better alternatives for the CFC refrigerants is still on the hunt. So instead of using conventional air conditioning systems, other products which can efficiently cool a person are to be devised. By using other efficient cooling mechanisms we can save the electricity bills and also control the greenhouse gases that are currently released into the atmosphere.

Lately a dramatic increase in the applications of TE coolers in the industry has been observed. It includes water chillers, cold plates, portable insulin coolers, portable beverage containers and etc.

II. Description Of Materials

2.1 LIST OF MATERIALS USED

Following are the materials used for designing of car air conditioning system by thermoelectric cooling unit using solar energy

a. Solar panel
b. Blower
c. Thermostats

d. Battery
e. Wires

A .SOLAR PANEL

A **solar cell** (also called a **photovoltaic cell**) is an electrical device that converts the energy of light directly into electricity by the photovoltaic effect. It is a form of **photoelectric cell** (in that its electrical characteristics—e.g. current, voltage, or resistance—vary when light is incident upon it) which, when exposed to light, can generate and support an electric current without being attached to any external voltage source.

WHAT IS PHOTOVOLTAIC MODULE?
Photovoltaic module

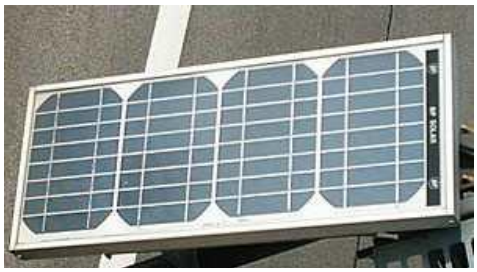


Figure: Photovoltaic module

In the field of photovoltaic, a photovoltaic module is a packaged interconnected assembly of photovoltaic cells, also known as solar cells. An installation of photovoltaic modules or panels is known as a photovoltaic array or a solar panel. Photovoltaic cells typically require protection from the environment. For cost and practicality reasons a number of cells are connected electrically and packaged in a photovoltaic module, while a collection of these modules that are
Mechanically fastened together, wired, and designed to be a field-installable unit, sometimes with a glass covering and a frame and backing made of metal, plastic or fiberglass, are known as a photovoltaic panel or simply solar panel. A photovoltaic installation typically includes an array of photovoltaic modules or panels, an inverter, batteries (for off grid) and interconnection wiring.

B. BLOWER

An electric motor with a fan designed to supply a current of air at a moderate pressure. A blower usually consists of a fan assembly, a motor, and a suitable case. The blower case is usually designed as part of the heating/air conditioning system. The blower is used for moving air from either an outside source--referred to as vented air--or from cabin air past the heater core or air conditioning evaporator. In doing so, it causes a heat transfer either to the inside of the car or from the inside to the outside. The majority of the vehicles have a blower motor under the dash, close to the kick panel on the right side of the car. There are, however, different locations for the heater core and evaporator. The blower will always be close to both.

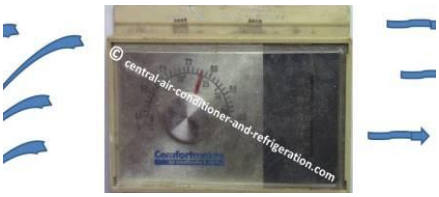
Direct current (DC) motors are widely used to generate motion in a variety of products. Permanent magnet DC (direct current) motors are enjoying increasing popularity in applications requiring compact size, high torque, high efficiency, and low power consumption. In a brushed DC motor, the brushes make mechanical contact with a set of electrical contacts provided on a commutate secured to an armature, forming an electrical circuit between the DC electrical source and coil windings on the armature. As the armature rotates on an axis, the stationary brushes come into contact with different sections of the rotating commutator.

C. WHAT IS THERMOSTAT?

A **thermostat** is a component of a control system which senses the temperature of a system so that the system's temperature is maintained near a desired set point. A thermostat may be a control unit for a heating or cooling system or a component part of a heater or air conditioner. Thermostats can be constructed in many ways and may use a variety of sensors to measure the temperature. The output of the sensor then controls the heating or cooling apparatus. A Thermostat may switch on and off at temperatures either side of the set point the extent of the difference is known as hysteresis and prevents too frequent switching of the controlled equipment

HOW DOES A THERMOSTAT WORK?

- Air conditioner thermostat works by depending on random air current.
- Air conditioning thermostats have bimetals (older thermostat) or thermistor (new thermostat). These bimetals or thermistor sense the air current returning to the return ducts or the surrounding air.
- The basic operation principle of air conditioning thermostat is it relies on random air current that passing thought it to determine the room temperature. It uses room temperature to compare with the set point temperature.



Ex. We are in heat mode and we set the temperature at 70°F. Let's said the air conditioning thermostat senses the random air current and the air current temperature is 65°F.
It'll keep running until it pickup air current that read 70°F and then it stop running.
All HVAC thermostat works on this principle. It doesn't matter if it digital, programmable, talking thermostat, telephone thermostats or zoning thermostat. It will rely on air current to works.

D. BATTERY :

In electricity ,a battery is a device consisting of one or more electrochemical cells that convert stored chemical energy into electrical energy.There are two types of batteries: primary batteries (disposable batteries), which are designed to be used once and discarded, and secondary batteries (rechargeable batteries), which are designed to be recharged and used multiple times. Batteries come in many sizes; from miniature cells used to power hearing aids and wristwatches to battery banks the size of rooms that provide standby power for telephone exchanges and computer data centers.

An **automotive battery** is a type of rechargeable battery that supplies electric energy to an automobile.[1] Usually this refers to an SLI battery (starting, lighting and ignition) to power the starter motor, the lights, and the ignition system of a vehicle's engine.

Automotive SLI batteries are usually lead-acid type, and are made of six galvanic cells in series to provide a 12 volt system. Each cell provides 2.1 volts for a total of 12.6 volt at full charge. Heavy vehicles such as highway trucks or tractors, often equipped with diesel engines, may have two batteries in series for a 24 volt system, or may have parallel strings of batteries.

Lead-acid batteries are made up of plates of lead and separate plates of lead dioxide, which are submerged into an electrolyte solution of about 38% sulfuric acid and 62% water. This causes a chemical reaction that releases electrons, allowing them to flow through conductors to produce electricity. As the battery discharges, the acid of the electrolyte reacts with the materials of the plates, changing their surface to lead sulfate. When the battery is recharged, the chemical reaction is reversed: the lead sulfate reforms into lead dioxide and lead. With the plates restored to their original condition, the process may now be constructed of many thin plates with thin separators between the plates, and may have a higher specific gravity electrolyte to reduce internal resistance.

III. List Of Parts Designed By Using PRO E Are As Follows:

1. Solar panel
2. Blower
3. Casing
4. Battery

1. Solar panel

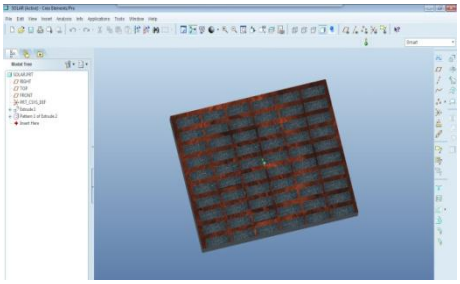


Fig: Solar panel

2. Blower

The fan (impeller) rotates inside the shell. The shell is so designed that the air is rushed out force. The blower consists of two main parts. They are

- D.C motor
- Impeller blades(Fan)

Fig: Blower

3. Casing

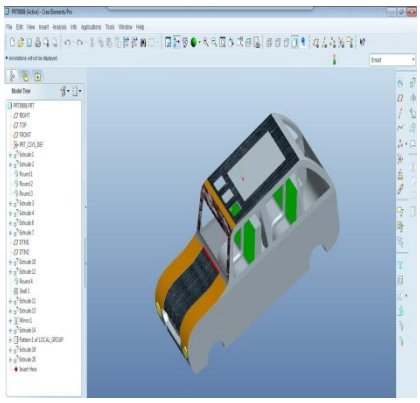
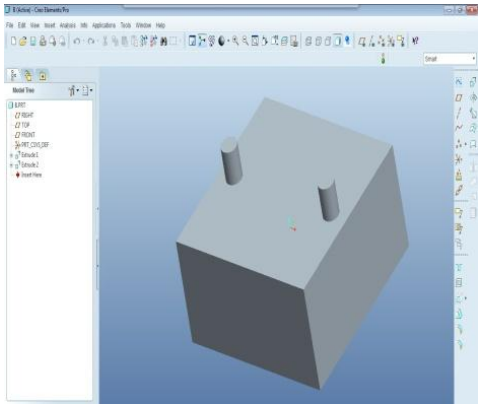


Fig: Casing

4.Battery:



ASSEMBLY

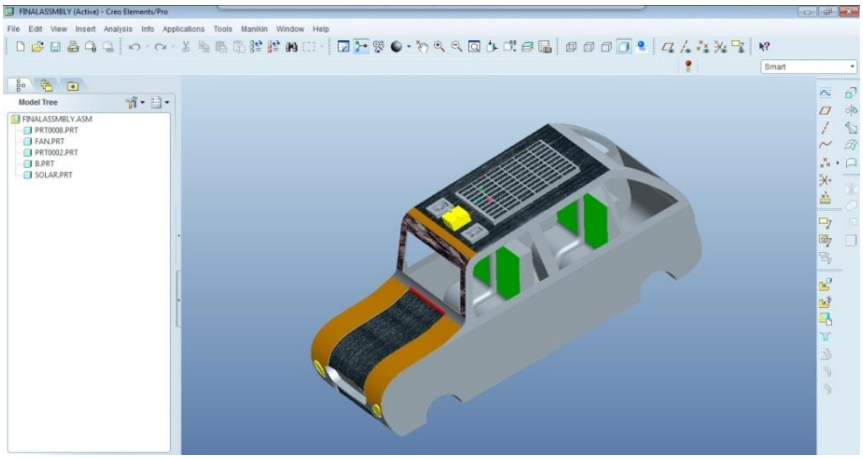


Fig : shows the assembly of all the parts in the vehicle

IV. Determination Of Temperature Inside Parked Car:

- A Maruti AULTO LXi car is used for experimentatio

S.NO	TEMP (ΔT)		TEMP. DIFFERENCE	HEAT GENERATION (Q)		HEAT GENERATION (Q) DIFFERENCE
	WITH	WITHOUT		WITH	WITHOUT	
1	3.18	10.68	7.5	14.96	48.7	33.74

Table :shows the experimental details of temperature variation in vehicle by using non conventional source of engergy

V. Experimental Setup

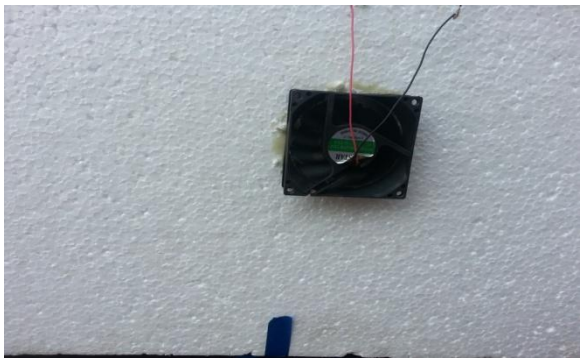
Parts required
1. Solar panel
2. Exhaust fans
3. Thermostat.
4. Battery
5. Charging circuit
6. Thermacole sheets.
7. Digital thermo meter

In this project we conducted experiment on maruti alto Lxi model
It's a small car segment, petrol engine, 800cc engine.
We conducted experiment in HYDERABAD, on 25march, 2014.

Atmospheric conditions in March month HYDERABAD.
Temperatures are 35 to 40 ^{0}c
Relative Humidity 35-40%
Air flow 5-10m/sec.
Components specifications:-
Solar panel:-
Output:-10V
Model No: - 1210
Company:-Sun field Engineering Pvt Ltd.

Solar panel:

Exhaust fans:-
12v, 0.25A current input, D.C motor, Model no:-C 8025B.
Fan Diameter:- 3Inches.

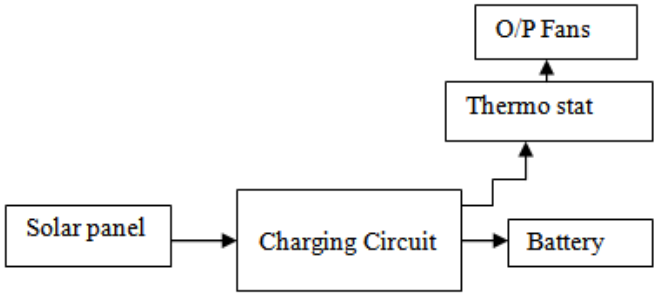


Thermostat: - D.C thermostat, it controls temperature from 30 to 80 ^{0}c.

Battery: - 12V, 7AH
Voltage regulation- cycle via 14.2 to 14.5V at 25^{0}C, 13.5 to 13.8 at 35^{0}C.

Charging circuit:
Max O/P Current- 6 ADC
Vmax I/P battery terminal -6Adc

Experimental setup block diagram:-



VI. Results And Discussions

In this project we done the experiment morning 1PM to 5.30PM. The following results are got. Also we have calculated amount off heat generated inside the cabin. The sunlight is diminished after 4PM at that time battery are used for running the fans. We have tested the battery for the time it has worked .It worked for 2.5 hours after sunlight are diminished.

VII. Conclusion

The interior of the car gets heated up when parked in sun. This is harmful for both living and non-living things present inside the car. This project is an effort to bring down this heat by providing proper ventilation. A smart system to ventilate the car is designed and relevant prototype is implemented.

This system consists of a ventilators placed at optimum positions and run with optimum power which depends on the temperature. From the above mentioned experimental investigation, it was evident that the solar PV powered ventilation system was successfully performed when tested for its intended application.

In this the results of test show that the rise car cabin temperature with ventilation system was lower compared to that without ventilation system. I this project we reduced temperature 6to7degrees in peak time. Also we control the temperature in the evening time by using battery power. By using this equipment we can control the temperature in small segment cars when these are parked in parking with out running engine. By using this system we can save fuel.

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International Journal of Engineering Science Invention (IJESI) is UGC approved Journal with Sl. No. 3822, Journal no. 43302.

Baltha Manoj Kumar "Heat Reduction in Car Cabin by Using Nonconventional Source of Energy." International Journal of Engineering Science Invention(IJESI), vol. 6, no. 12, 2017, pp. 48-54.