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# Solar Powered Heat Control System for Cars

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**Abstract**
It takes times for an air-conditioner to effectively start cooling the passenger compartment in the car. So the passenger of the car will feel the heat in the car extremely before the air-conditioner fully cooling the interior of the car. Excessive heat can also damage an automobile's interior as well as personal property kept in the passenger compartment. So, a system to reduce this excessive heat by pumping out hot air and allowing cooler ambient air to enter the car by means of two micro fans was made. Also a cooling chamber was set up around the inlet fan to cool it a little further.
***Keywords*** – Air conditioner, Cooling Chamber, Micro fans, Solar panel.

## I. INTRODUCTION

A device was fabricated that controls the heat development rate in parked cars with the help of solar energy powering. The working of this device is based on Newton's law of cooling. A study is conducted to measure the temperature inside of the cars that all directly exposed to the sun, with no major shadows on any of them and activities to choose the suitable apparatus that will be used to develop a device for dissipating heat from a car.. System consists of two micro high efficiency fans for circulation of air into and out of the parked cars. One fan is for inlet and the other for outlet actions respectively. The inlet air forced in by the micro fan is passed through a closed chamber containing a coolant. The coolant primarily used is liquid acetone. The electric power required for the functioning of the two micro fans are harnessed by solar panels by solar energy harnessing principle

This paper deals with to design a device for heat removal inside a car which will help to cooling down the temperature in the car and reduce the excessive heat felt by the passenger of the car on vehicle start-up, besides reduce the damage an automobile's interior as well as personal property kept in the passenger compartment.

## II. LITERATURE SURVEY

The main reference that has been utilized for doing this paper is the journal of "How is Interior of Car Parked under Sun Much Hotter than Atmosphere? "by Jonathan and Grabianowski It can be said that our project is a simplified and cost efficient model of the prototype in the journal. The next reference is Lange's Handbook of Chemistry that provided us with relevant information about the coolant that can be used in our project.

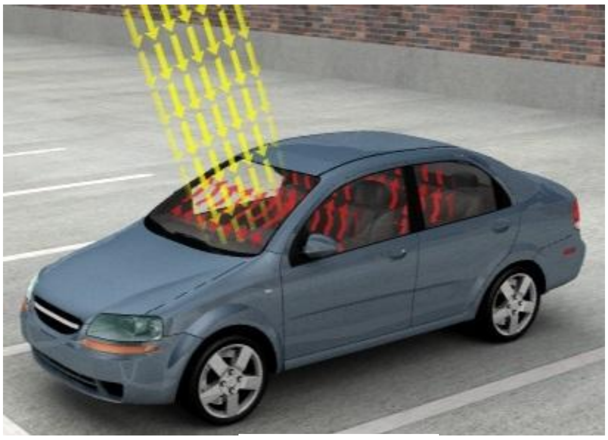

**Figure 1** Heat effect on cars

On a typical summer day, the temperature inside a parked car can be as much as 30-40 degrees hotter than the outside temperature, ie. on a 30-degree day the temperature inside the car could be as high as 70 degrees. Seventy five percent of temperature rise occurs within five minutes of closing the car and leaving it, ie. On a 36 degree day the car will have reached 55 degrees, within five minutes. Ninety percent of the temperature rise occurs within 15 minutes.

| S.NO | COMPONENT |
|---|---|
| 1 | Rubber beading |
| 2 | Solar panel |
| 3 | Supply Connector |
| 4 | Device outlet |
| 5 | Device inlet |

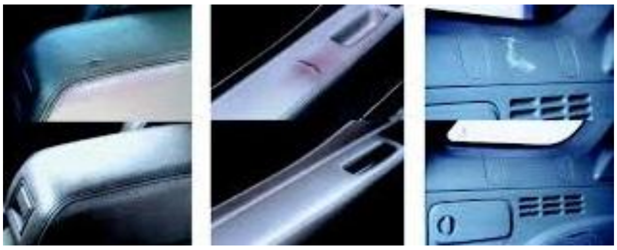

**Figure 2** Heat effect on car interiors

**Table 1** Components

The role of heat transfer in our mechanical engineering project is unquestionable. Fundamentals of Heat and Mass Transfer, came in useful here .The theory and working principle of the project has been adapted from this book. And finally, the' Sustainable energy systems engineering: the complete green building design resource. McGraw-Hill Professional' was helpful in providing us information and data about the energy source that can be used in our project.

## III. METHOD AND DISCUSSION

Our device can control the heat development rate is called a heat control system .In this paper the device controls the heat development rate in parked cars with the help of solar energy powering. The working of this device is based on Newton's law of cooling by heat removal inside a car which will help to cooling down the temperature in the car

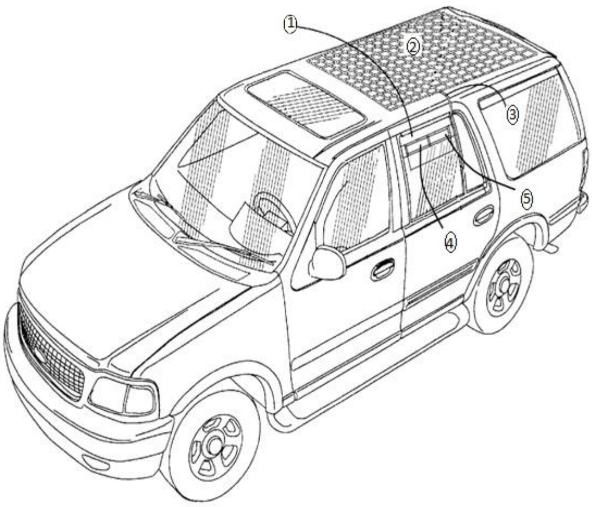


**Figure 3** Proposed solar powered heat control system

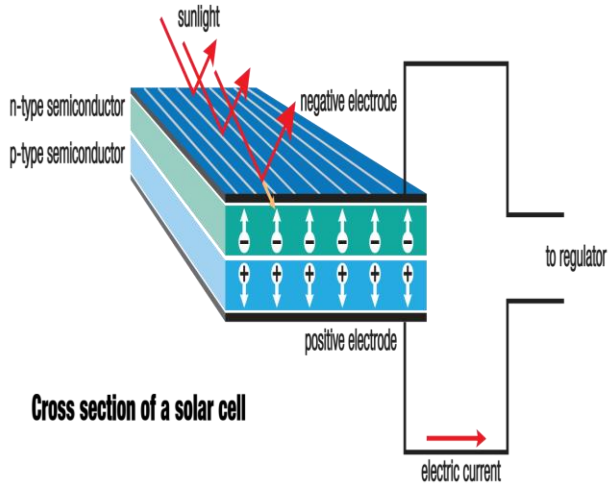


**Figure 4** Cross section of a solar panel

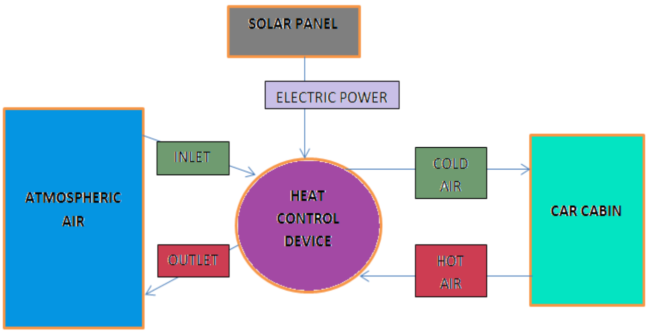


**Figure 5** Block diagram of solar heat control system

The figure shows the simple block diagram of solar powered heat control system. The heat control device consists of two micro fans one for inlet and the other for outlet and a cooling chamber in the inlet side. the inlet atmospheric air fed to the device is passed through a cooling chamber consisting of liquid acetone .the cooled air is circulated in the car cabin due to inlet fan force and the warm cabin air is pushed out through the outlet of the device .the primary source of power for the operation is harnessed from solar panel

## IV. DESIGN SPECIFICATIONS

The frame being the most important part of the system had to be designed first. We first made a model of the frame and tested it on a car. Finally, we had to improve our design. Designing of the frame was mainly done on AutoCAD. The final frame structure was fabricated with 2mm thick iron sheet by gas welding operation.

The frame was designed in such a way that the inlet side can hold a coolant chamber which has the shape of the English alphabet "U". The bottom of the coolant chamber is 2cm thick and the sides being 1cm each.

**SPECIFICATIONS OF FRAME**

**Frame material** **:** Iron sheets 2mm thick
**Length** **:** 16.8 cm
**Breadth** **:** 13 cm
**Height** **:** 8.4 cm
**Inlet Area** **:** 6.4 x 3.5 $cm^2$
**Outlet Area** **:** 8.4 x 3.5 $cm^2$

The other components used were 280mm square CPU micro fans for inlet and outlet. As the coolant Acetone, which has boiling point at 56.2°C was used in the acetone chamber which was a part of the frame. The power for running the fans was generated by a 10W solar panel. A flux hose was also used so that the inlet air would be dispersed as far away from the outlet mouth of the frame thus avoiding scavenging of the cool inlet air through the outlet port. The final component used was a digital thermometer that allowed to measure the slightest variation in temperature accurately.

| **LIQUID ACETONE ($CH_3COCH_3$) COLLANT** | |
|---|---|
| Specific gravity | 0.0786 |
| Melting Point | -94$^0$C |
| Boiling Point | 56.5$^0$C |
| Relative vapour density | 0.788 |
| Flash point | -18$^0$C |

**Table 2** Properties of Acetone

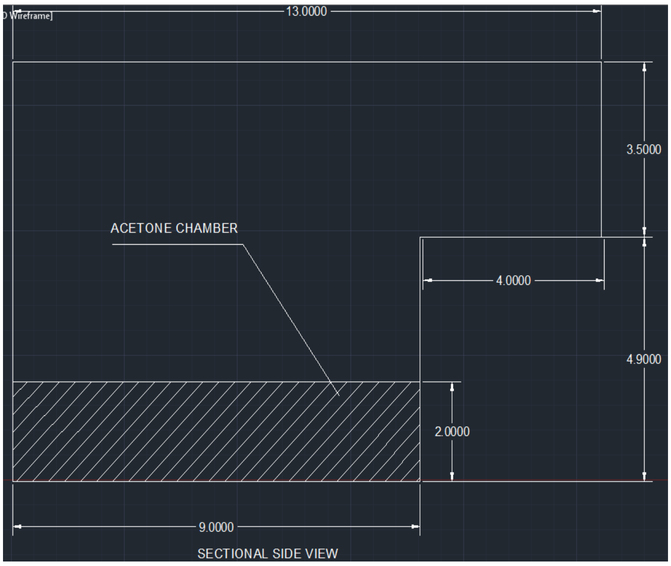


**Figure 6** Sectional side view

## V. TEST AND RESULTS

**TEST DETAILS**

CAR MODEL : Maruti Swift Dzire
TEST DATE : 13.4.2013
TEST VENUE : Thrissur, Kerala
START OF TEST : 1:00 PM Afternoon
END OF TEST : 2:00 PM Afternoon
Avg. ambient atm. Temp. : 36.8 $^oC$
Thermometer Head Position : middle of car cabin

**Figure 7** Parked car without system installed

**Figure 8** Parked car with system installed

**Table 3** Case study details

| CASE | SYSTEM DETAILS |
|---|---|
| I | Parked Car without system installed |
| II | Parked car with system installed (no coolant). |
| III | Parked car with system installed (with acetone coolant) |
| IV | Parked car with system installed (with acetone coolant, no flex hose) |

Above table, this shows the key characteristics of these case study approaches in their forms as well as the characteristics of mixed research approaches. We will discuss a few of these here.

| CASE | TEMPERATURE INSIDE CAR CABIN | | | FLEX HOSE |
|---|---|---|---|---|
| | ***After 1 min*** | ***After 5 min*** | ***After 10 min*** | |
| **I** | 54.8 | 57.7 | 60.5 | - |
| **II** | 53.3 | 54.1 | 55.8 | Present |
| **III** | 50.5 | 54.8 | 56.4 | Present |
| **IV** | 51 | 52.3 | 52.1 | Not present |

**Table 4** Case study data

In case I, when the system was not installed, the temperature inside the car cabin increased with a steady pace.

In case II, when the system was installed with no coolant in it, the temperature inside the car cabin increased with a low pace for the first 5 minutes, then increased with much higher pace to the next 10 minutes.

In case III, when the system was installed with acetone coolant in it, the temperature inside the car cabin increased with a high pace for the first 5 minutes, then decreased with much lower pace to the next 10 minutes.

In case IV, when the system was installed with acetone coolant in it and with no flex hose, the temperature inside the car cabin increased with a very low pace for the first 5 minutes, then decreased with a constant pace to the next 10 minutes and then remained approximately constant

The solar powered heat control system was tested taking into account different case scenarios. It was observed that the heat control was much observed in Case IV where the car cabin was installed with the solar powered heat control system containing acetone coolant and no flex hose.

A graph was plotted with the data obtained during the case study with Time along the X-Axis and Temperature along the Y-Axis.

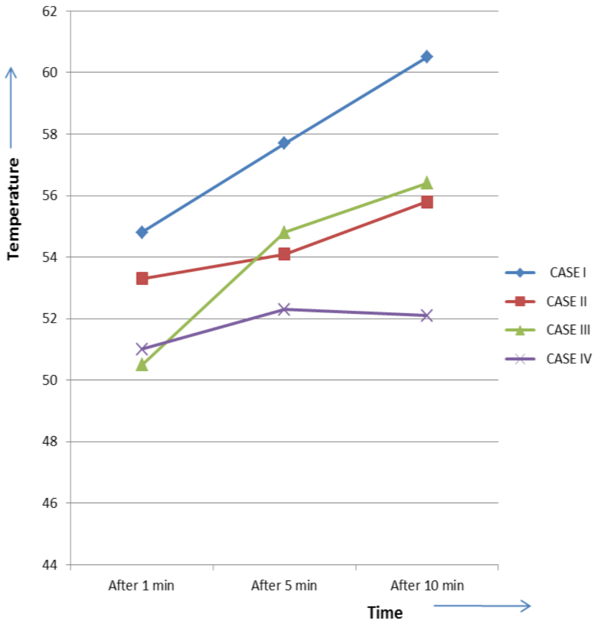


**Figure 9** Graphical analysis

## VI. CONCLUSION

In this present work, Case IV when the system was installed with acetone coolant in it and with no flex hose, the temperature inside the car cabin increased with a very low pace for the first 5 minutes, then decreased with a constant pace to the next 10 minutes and then remained approximately constant. Thus it was clear from the above case that the temperature rise inside the car cabin was overcome by the cooling rate offered by the system, the device with this configuration showed very improvement in the heat control activity. The device works completely on green energy and showed an average of $8.4^0$C reduction within a short interval and maintained the temperature inside the car cabin bearable for human body.

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## REFERENCES

[1] R. Saidur, H.H. Masjuki, M. Hasanuzzaman. (2009). Performance of an Improved Solar Car Ventilator. International Journal of Mechanical and Materials Engineering (IJMME), Vol. 4, No. 1, pp 24-34, 2009
[2] Jonathan and Grabianowski (2002), How is Interior of Car Parked under Sun Much Hotter than Atmosphere?", AM Jounal- 2002
[3] A. Mezrhab, M. Bouzidi (2004). "Computation of Thermal Comfort Inside a Passenger Car Compartment". Applied Thermal Engineering, 26 (14-15), 1697-1704.
[4] Kaynakli, O., Unver, U., Kilic, M. (2002). "Simulation of thermal comfort heating and cooling periods in an automobile compartment". Proceedings of the Automotive Technologies Congress, pp. 127-135, 24-26 June, Bursa, Turkey.
[5] M.A. Jasni and F.M. Nasir. (2012). "Experimental Comparison Study of the Passive Methods in Reducing Car Cabin Interior Temperature". Proceedings of the International Conference on Mechanical, Automobile and Robotics Engineering (ICMAR'2012), Dec., Penang, Malaysia.
[6] M.H. Salah, T. H. Mitchell, J.R. Wagner and D.M. Dawson. (2009). "A Smart Multiple-Loop Automative Cooling System – Model, Control and Experimental Study". IEEE/ASME Transactions on Mechatronics, Vol. 15, Issue 1, pp. 117-124.
[7] Incropera, F. P. (2001). Fundamentals of Heat and Mass Transfer, 5th Ed. Wiley. ISBN 978-0471386506
[8] N.A.G. Martinho, M.C.G. Silva, J.A.E Ramos. (2004). Evaluation of Thermal Comfort in a Vehicle Cabin. Proceedings of the I MECH E Part D, Journal of Automoblie Engineering, 218 (2), 159-166.
[9] M.F. Basar, M. Musa, M.Y. Faizal, N.H.A. Razik, (2013) "Alternative Way in Reducing Car Cabin Temperature Using Portable Car Cooling System (Car-Cool)" (IJITEE) Volume-3, Issue-3, August.
[10] Lange's Handbook of Chemistry, 10th ed, pp 1522-1674
[11] H.H. Al-Kayiem, M.F. Sidik, Y.R. Munusamy (2010). "Study on the Thermal Accumulation and distributin inside a Parked Car Bin", American Journal of Applied Science, 7(6):784-789.
[12] Peter Gevorkian (1 August 2007). "Sustainable energy systems engineering: the complete green building design resource". McGraw-Hill Professional. pp. 498 February 2012.
[13] Nebojsa I. Jaksic and Cem Salahifar. (2003). "A feasibility study of electrochromic windows in vehicles", Solar Energy Materials and Solar Cells, 79, 409-423
[14] C. Bureau, H. Kampf, B. Taxis-Reischl, A. Traebert, E. Mayer, R. Schwab.(2003). "Method to assess thermal comfort", Vehicle Thermal Management Systems Conference

Proceedings, SAE paper No. C599/005/2003, 223-233.

[15] K.David Huang, Sheng-Chung Tzeng, Wei-Ping Ma, Miing-Fung Wu. (2005) Intelligent Solar-Powered automobile-Ventilation System, Applied Energy,80, 141-154.

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