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# CABIN THERMAL MANAGEMENT FOR EV CARS

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***Abstract:*** The main objective is to study and review of solar air conditioning system in cars based on thermo-electric module which works on Peltier principle. This system is eco-friendly, based on renewable energy source and suitable. The basic difference between the conventional and solar based thermo-electric air conditioning system is that in this system there is no mechanical part or refrigerant been used, so there will no power gone waste in moving parts nor the system is going to be noisy, a part of this as there is no hazardous emission to the environment so the system is totally eco-friendly. As the Peltier module is quite compact in size the design can be easily acquired according to space and need. To design and implementation of a low-cost solar powered car, this system is targeted towards high ambient temperature changes may cause interior damage to the car and pose a significant burn threat for young, disabled or elderly passengers. This system is to significantly reduce the temperature inside the parked vehicle without starting the engine. The proposed cooling prototype utilizes thermo-electric element to cool the air inside the car and micro fan system to accelerate the heat exchange. The system is powered by the external battery and recharged by the top mounted solar panels. The cooling effects approximately in the range of comfort zone, but can be significantly boosted by the increased power and improved heat exchange.

***Index Terms*** **– Thermal Management System, Thermoelectric Module**

## I. INTRODUCTION

With the booming of automobile industry, more and more fossil fuel has been burnt in the cars. Now new energy is increasingly adopted in the cars. This project is mainly about the application of solar energy in the vehicles. When Cars Park exposed to the sunlight, temperature inside the cabin would increase substantially. Some ventilation system works directly using electricity energy of storage battery, which would consume a large amount of electricity and does harm to the life of storage battery. In this passage solar panel is fixed on the car roof. When cars park in the sunlight, the cabin blower would be driven by the solar panel. In this way, electricity energy from storage battery could be saved. When the vehicle parks in direct sunlight conditions, the cabin will form a high-temperature thermal environment in hot weather. Drivers would turn on the air-conditioning with relatively high gear in the most conditions to reduce the cabin temperature, which could affect the life of equipment, resulting in energy waste and increasing emissions. This study adopted solar energy in the ventilation system. When the car parks the cabin blower was driven by a solar panel mounted on the car roof to discharge heat inside the cabin real time, achieving the purpose of pre-cooling.

## II. LITERATURE REVIEW

Panuganti Sai Preetham, "Fabrication of Car Ventilation System Using Solar Energy" [1]- The refrigerating units currently used in road transport vehicles are vapor 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 calculating the cooling load required for the 5-passenger car. By considering all load factor like heat gain by window glass, roof, engine, persons, and audio system. Second aim of the project is mostly if car is parking area in direct sunlight by closing all windows inside the temperature will increases up to 50 to 60 deg. But our comfort temperature is 25 to 28 deg.For getting down that temperature it takes time and requires lot of cooling load. For avoiding this problem in this project design of an exhaust fan worked by using solar energy is done. It sucks the inside hot air and it maintain outside air temperature when car is parked under sunlight. Fan will be controlled by temperature controller where the temperature is set to outside air. By using this we can reduce the cooling load that is required for car while it is in parking. Software used in this project is Creo for modeling. Keywords— refrigeration, load factor, temperature

Dr. Pushpendra Singh," Alternate System for Car Cabin Comfort Cooling Solar Powered" [2]- Nowadays, a car is one the most important transportation for individual compared to public transport. Parking spaces are constricting day by day and people are forced to park their car in open spaces under the scorching sun. High solar global insolation in India causes typically very high ambient temperature. During summer if the cars are parked directly under the sun, then the exposed cabin inside the car will produce greenhouse effect. This will lead to higher cabin temperatures and cause problems like Fire burst, emission of harmful poisonous gases, color fading, wear and tear of cabin elements etc. In this paper we are trying evaluate a simple cooling and ventilation system powered by solar energy to purge the hot air trapped inside the cabin. Key words: Car, Cabin, Cooling, Solar.

Vignesh.G1, Sanketh A.V2, Shubham S Bellundagi," Solar Powered Air-Cooling system for Idle Parked Cars" [3]- When a car is parked under the sun for longer time, the car cabin gets heated up. The temperature inside may rise to around 60 to 70 degrees, which makes the passengers feel uncomfortable inside the car moreover these high temperatures cause health problems. In order to overcome these problems, the passengers switch on Air Conditioner which leads consumption of fuel energy or open up all the doors and windows and waste time. To eliminate these problems a SOLAR POWERED AIR-COOLING SYSTEM can be installed in the car. This system uses a solar panel to capture the sunlight and convert the Solar energy into the Electrical energy which is used to recharge the 12V battery, which then gives necessary power for the cooling module which consist of Peltier Thermoelectric cooler and fan motor. The cool air is blown inside the car which reduces the temperature in the car cabin. The system is controlled by using a switch device. The installation of SOLAR POWERED AIR-COOLING SYSTEM in the cars, would be a better solution as it uses solar power to cool down the inside temperature of the car which is parked in the hot sun to more acceptable temperature.

# III. RESEARCH METHODOLOGY

## 3.1 SYSTEM ARCHITECTURE

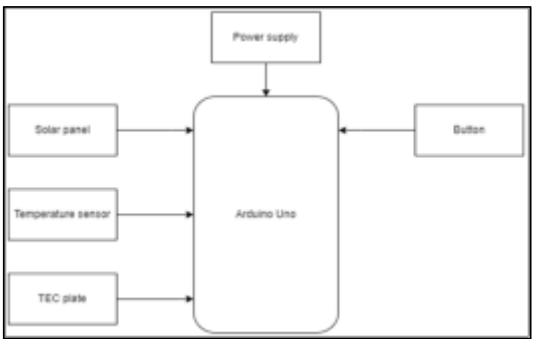



Fig. 3.1 System Architecture

Here in this project Arduino UNO is main controller. Temperature sensor, TEC plate are other components we are using as hardware part. For the temperature sensors are used. System continuously checks for the values of sensors. If there is change in value system will notify.

## 3.2 COMPONENT INFORMATION

### ARDUINO UNO

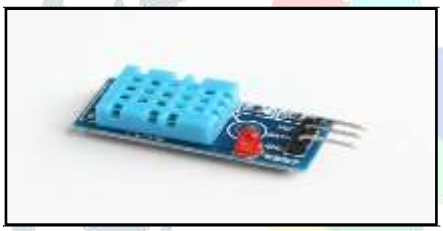
Arduino UNO is an open-source microcontroller board based on the ATmega328P. It was designed and manufactured by the Arduino LLC in Italy. It has 14 digital input/output pins, 6 analog inputs, a 16 MHz quartz crystal, a USB connection, and a power jack. The board is equipped with a number of sensors such as a temperature sensor, light sensor, and humidity sensor, among others, which can be added as per the requirements of a project. With its simple and accessible user interface, Arduino UNO is widely used for various DIY electronics projects, robotics, and Internet of Things applications. Arduino Uno is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button.

Specifications: -
Microcontroller: ATmega328P
Operating Voltage: 5V
Input Voltage (recommended): 7-12V
Input Voltage (limit): 6-20V
Digital I/O Pins: 14 (of which 6 provide PWM output)
Analog Input Pins: 6
DC Current per I/O Pin: 40 mA
DC Current for 3.3V Pin: 50 mA
Flash Memory: 32 KB (of which 0.5 KB used by bootloader)
SRAM: 2 KB
EEPROM: 1 KB
Clock Speed: 16 MHz
Length: 68.6 mm
Width: 53.4 mm
Weight: 25 g
Connectivity: USB, power jack, ICSP header

**TEMPERATURE SENSOR**

The Temperature sensor can either be purchased as a sensor or as a module. Either way, the performance of the sensor is same. The sensor will come as a 4-pin package out of which only three pins will be used whereas the module will come with three pins as shown above.

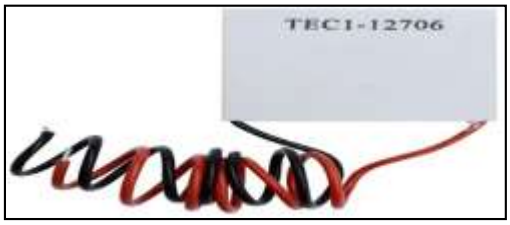
Specifications: -
Operating Voltage: 3.5V to 5.5V
Operating current: 0.3mA (measuring) 60uA (standby) Output: Serial data
Temperature Range: 0°C to 50°C
Humidity Range: 20



**TEC PLATE**

TEC12706 The semiconductor cooler gives us a new concept of heat dissipation, which further controls the temperature of the CPU. This TEC1-12706 60W 12V Pettier thermo electric cooler is perfect for application requiring heating or cooling such as small DIY refrigerators, custom drink heaters/coolers, and electronic component and device chillers or heaters.

Specifications: -
Model: TEC1-12706
Size: 40mm x 40mm x 4mm
Working current: Typically, 3-4 A (rated 12V); Imax: 6A



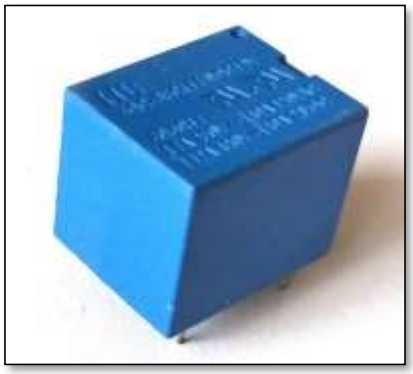
## SOLAR PANEL

A Solar panel (also known as "PV panels") is a device that converts light from the sun, which is composed of particles of energy called "photons", into electricity that can be used to power electrical loads. Solar panels can be used for a wide variety of applications including remote power systems for cabins, telecommunications equipment, remote sensing, and of course for the production of electricity by residential and commercial solar electric systems. The obvious would have to be off-grid living. Living off-grid means living in a location that is not serviced by the main electric utility grid. Remote homes and cabins benefit nicely from solar power systems. No longer is it necessary to pay huge fees for the installation of electric utility poles and cabling from the nearest main grid access point. A solar electric system is potentially less expensive and can provide power for upwards of three decades if properly maintained. Besides the fact that solar panels make it possible to live off-grid, perhaps the greatest benefit that you would enjoy from the use of solar power is that it is both a clean and a renewable source of energy. With the advent of global climate change, it has become more important that we do whatever we can to reduce the pressure on our atmosphere from the emission of greenhouse gases. Solar panels have no moving parts and require little maintenance. They are ruggedly built and last for decades when properly maintained.

## RELAY

Relays are most commonly used switching device in electronics. Before we proceed with the circuit to drive the relay, we have to consider two important parameter of the relay. Once is the Trigger Voltage this is the voltage required to turn on the relay that is to change the contact from Common->NC to Common->NO. Our relay here has 5V trigger voltage, but you can also find relays of values 3V, 6V and even 12V so select one based on the available voltage in your project. The other parameter is your Load Voltage & Current, this is the amount of voltage or current that the NC, NO or Common terminal of the relay could withstand, in our case for DC it is maximum of 30V and 10A. Make sure the load you are using falls into this range.

Specifications: -
Trigger Voltage (Voltage across coil): 5V DC
Trigger Current (Nominal current): 70mA
Maximum AC load current: 10A @ 250/125V AC
Maximum DC load current: 10A @ 30/28V DC
Compact 5-pin configuration with plastic moulding
Operating time: 10msec Release time: 5msec
Maximum switching: 300 operating/minute (mechanically)



## IV. RESULTS

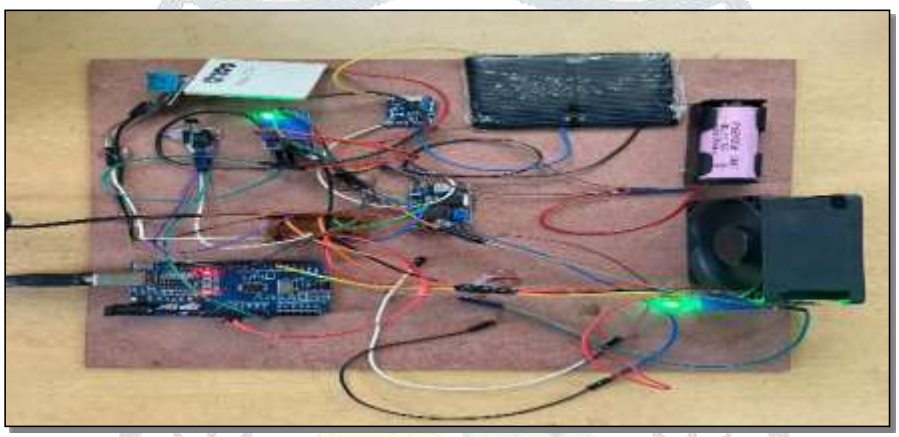


Fig. 4.1 Hardware

Fig. 4.2 Output

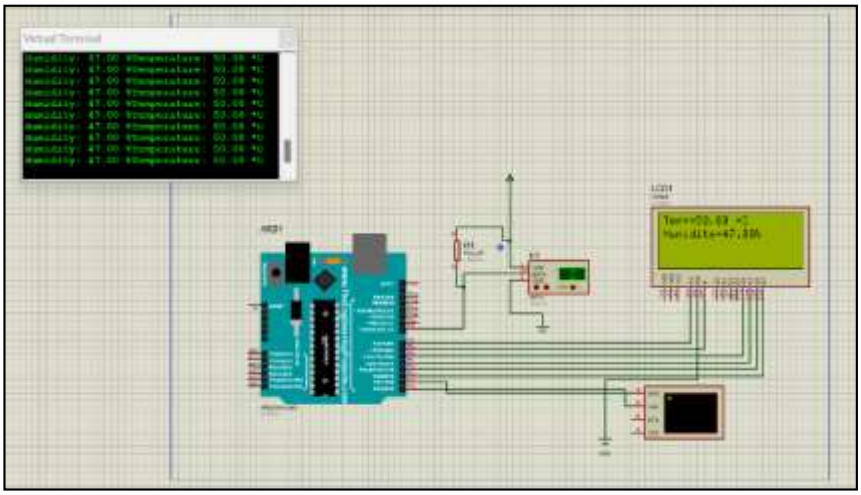


Fig. 4.3 Stimulation

## V. CONCLUSION AND FUTURE SCOPE

### 5.1 CONCLUSION

Due to increasing pollution the heat waves coming from the sun is more nowadays. The temperature in the atmosphere is increasing day by day. The car cabin of the parked car gets exposed to extreme temperature. We implement a prototype system of Maintain Car Cabin Temperature when Engine is Off, which works on reduces the heat inside the Maintain cars and give comfort to the passengers. The result obtained from the project is a heat reducing system which operates on renewable source of energy.

### 5.2 FUTURE SCOPE

We are expecting to reduce the cabin temperature of EV vehicles since due to increase in pollution the heat waves coming from the sun is more nowadays. The temperature in the atmosphere is increasing day by day. The car cabin of the parked car gets exposed to extreme temperature. We implement a prototype system of Maintain Car Cabin Temperature when Engine is Off, which works on reduces the heat inside the Maintain cars and give comfort to the passengers. The result obtained from the project is a heat reducing system which operates on renewable source of energy.

## VI. ACKOWLEDGEMENT

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