# PROLONGINGAIRCONDITIONINGTIMEAFTERIGNITIONTURNED OFF

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*Abstract : Our project report is mainly on the analysis of automobile air conditioning system, which is existing. In this project a new mechanism of an automobile air conditioning system is suggest to reduce the fuel consumption and load on engine. In this project we have studied on the workshop testing engine and study its mechanism of air conditioning system and conclude that the AC system of car is completely works through engine power. Which consume the more fuel, that is why it reduce some percentage of fuel economy and also increase the load on engine. With the help of our idea of using solar panel in A.C. system after ignition is turned off, we can get more fuel economy and reduce the load on engine when the AC system of car is in working condition, which is useful to saving a more fuel consumption and battery power. Our new project is for the L.M.V., S.U.V, Bus and cars.*

*IndexTerms* – Car, Air Conditioner,Compressor,Condensor,Solar panel,Direct Current Motor,Battery

## **I.** INTRODUCTION

A company in new York city in the united states, first offered installation of air conditioning for car in 1933. Before some decades ago air conditioning in cars was rare and driving in summer was nothing short of sweaty experience. There was only a handful technician who could install AC units on Indian car and also maintain imported car A.C. One opening the bonnet of car one could recognize who has installed that particular unit as good as recognizing a friend's handwriting. The use of refrigeration and air conditioning for transporting purpose proves to be very advantageous. Air conditioning is very much used in cars i.e. Automobiles, railways, airplanes and ships. The use of air conditioning in automobiles is a luxury in India but it is commonly used in western countries to provide better human comfort. Today automobile air conditioning has acquired a growing market. The new cars are so designed as to accommodate A.C. in its cabin. Automobile air conditioning system works on the principle of vapour compression refrigeration cycle and employees R134a as refrigerant to run the system.

## **II.**LIST OF ABBREVIATIONS

**1.** A.C= air conditioning
**2.** S.U.V= sport utility vehicle
**3.** L.M.V= Light Motor Vehicle
**4.** hp = Horsepower
**5.** R.P.M = Revolution Per Minute
**6.** Hr = hour
**7.** Km = kilometer

## **III.** DESIGN CALCULATION:

LOAD CALCULATION OF OUR SYSTEM

Battery specification: - 12V. 100AH So the power:- P = V*I
= 12* 100
= 1200 watt.

Now the compressor specification:-
0.5HP DC motor specification:-
1HP @1700 R.P.M.

So combining both compressor and motor load,
1.5HP = 1.5*746 =1119 watt
Now the time required for draining the battery is =
= Power Available / Power consumed
= 1200/1119
=1.07 hrs
Hence, the draining time of the battery is 67 minute. Solar panel calculation:-

Assuming 90% charged battery Power
= 1200 * 0.90
=1080 W

Suppose we take 6 hr to charge battery. Then 1080/6 = 180 W solar panel require.

Considering losses due to irradiance temperature conversion and battery losses.
Assuming 20 – 30% losses (avg 25%)
=180*(1+0.25)
Solar panel required =225 W

## IV. ADVANTAGES:

1. Reduce the engine load.
2. It reduces fuel consumption and provides good fuel economy.
3. It provides instant cooling as compare to general car AC system which is operated by engine shaft.
4. We can get good pickup during running of AC system.
5. By reducing engine load, the engine efficiency is also increase.
6. We can get cooling effect while ignition is in off condition.

## V. DISADVANTAGES:

1. Initial cost of car will be increase.
2. This system requires more space to install it.
3. Maintenance of this system is also complicated.
4. The overall weight of the car will also increase.

## VI. COMPONENTS

### 1. COMPRESSOR:

The compressor is the work horse of the air conditioning system, powered by a drive belt connected to the crankshaft of the engine. When the air conditioning system is turned on, the compressor pumps refrigerant vapour under high pressure to the condenser. The Function of compressor is to compressed the gas and send it to refrigeration system. The compressed refrigerant increases in pressure and temperature. The refrigerant used is also known as Tetrafluoroethane. R-134.

Figure 1. compressor

### 2. CONDENSOR:

The condenser consist of coils of pipes in which the high pressure and temperature vapor refrigerant is cooled and condensed. The condenser is a device used to change the high-pressure refrigerant vapor to a liquid. It is mounted in front of the engine's radiator, and it looks very similar to a radiator. The vapor is condensed to a liquid because of the high pressure that is driving it in, and this generates a great deal of heat. The heat is then in turn removed from the condenser by air flowing through the condenser on the outside.

Figure 2. condensor

### 3. RECEIVER

The condensed liquid refrigerant from the condenser is stored in vessel known as receiver from where it is supplied to the evaporator through the expansion valve. The now liquid refrigerant moves to the receiver-dryer. This is a small reservoir vessel for the liquid refrigerant, and removes any moisture that may have leaked into the refrigerant. Moisture in the system causes havoc, with ice crystals causing blockages and mechanical damage.

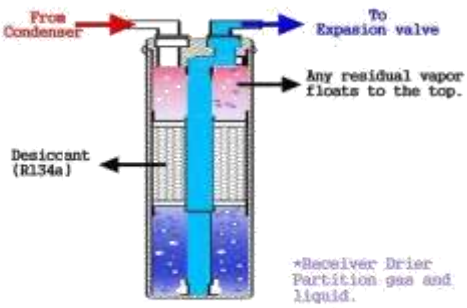



Figure 3.receiver

**4.** EXPANSION VALVE

It is also called refrigerant control valve. The function of the expansion valve is to allow the liquid refrigerant under high pressure and temperature to pass at a controlled rate after reducing its pressure and temperature. Some of the liquid refrigerant evaporates as it passes through the expansion valve, but the greater portion is vaporized in the evaporator at the low pressure and temperature.The expansion valve is simply an adjustable hole for the refrigerant to flow through. There is a small temperature bulb which attaches to the outlet pipe from the evaporator and will open and close the opening inside the expansion valve depending upon the temperature of evaporator.The red lines indicate high pressure side which is come from the receiver. The blue lines indicate low pressure one side of the expansion valve will be around 200 psi and the other side will be around 35 psi. This now low pressure liquid refrigerant flows from the expansion valve directly into the evaporator.

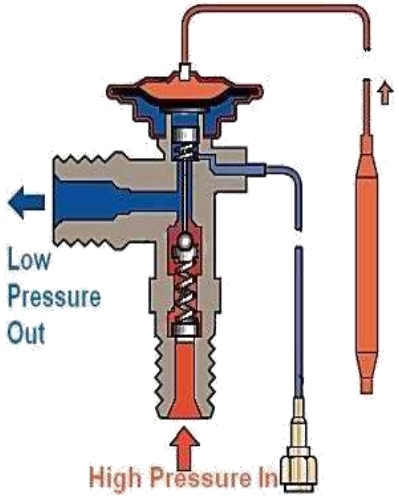



Figure 4. Expansion valve

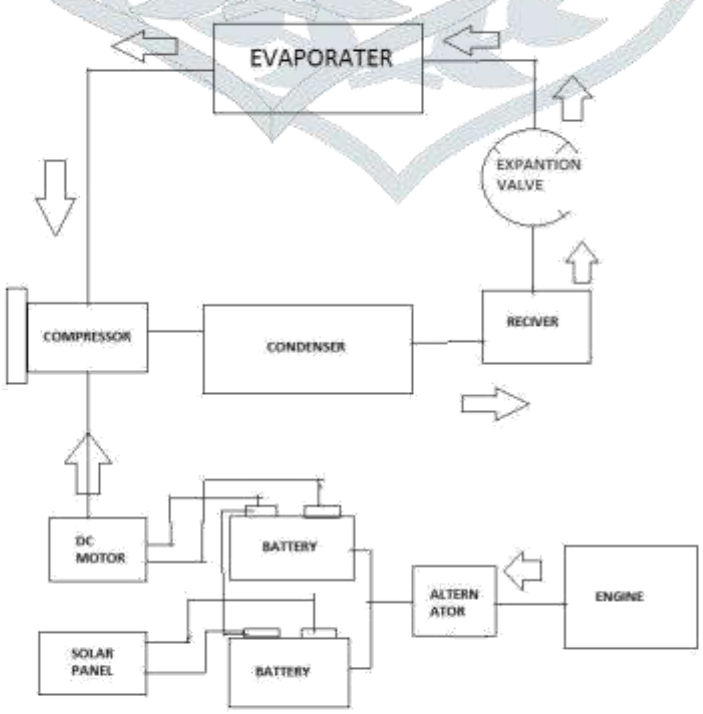
**5.** EVAPORATOR

The evaporator is another device that looks similar to a car radiator. It has tubes and fins and is usually mounted inside the passenger compartment. As the cold low-pressure refrigerant is passed into the evaporator, it vaporizes and absorbs heat from the air in the passenger compartment. The blower fan inside the passenger compartment pushes air over the outside of the evaporator, so cold air is circulated inside the car. On the 'air-side' of the evaporator, the moisture in the air is reduced, and the 'condensate' is collected and drained away.

Power– 0.5 HP
Requires 12 V current.
It needs earthing on battery terminal.

Figure 5. Evaporator

**VII.** SPECIFICATION OF OUR SYSTEM



Photovoltaic modules use light energy from the Sun to generate electricity through the photovoltaic effect. The majority of modules use wafer-based crystalline silicon cells or thin-film cells. The structural ( load carrying) member of a module can either be the top layer or the back layer. Cells must also be protected from mechanical damage and moisture. Most modules are rigid, but semi-flexible ones are available, based on thin-film cells. The cells must be connected electrically in series, one to another. Externally, most of photovoltaic modules use connector's type to facilitate easy weatherproof connections to the rest of the system.Modules electrical connections are made in series to achieve a desired output voltage and/or in parallel to provide a desired current capability. The conducting wires that take the current off the modules may contain silver, copper or other non- magnetic conductive transition metals.

Bypass diodes may be incorporated or used externally, in case of partial module shading, to maximize the output of module sections still illuminated. Some special solar PV modules include concentrators in which light is focused by lenses or mirrors onto smaller cells. This enables the use of cells with a high cost per unit area (such as gallium arsenide) in a cost-effective way.

D.C MOTOR(Direct Current Motor) A DC motor converts the electrical energy in to mechanical energy.

DC motor voltage: - 12 V, rpm: - 2000 rpm, 1 HP.

The DC motor is run by the electric current which is given by battery.

The DC motor shaft pulley is connected with the compressor pulley by the belt. The DC motor shaft pulley diameter is more than compressor pulley.

A compressor is run by DC motor continuously in both ON and OFF condition of engine.

The different parts of DC motor are given below. There are two main parts of DC motor.

ESTIMATION OF OUR SYSTEM

- Why it is necessary?

  Car gives 20km/litre mileage without air conditioner work and 16km/litre with air conditioner work. Fuel price is 70 Rs/litre. A car runs nearly one lakh km in 10 years of life

- Fixed Cost:

  Hence Panel cost =6500
  Cost of Lead acid battery
  = 5500 Cost of DC motor
  = 5000
  Total initial cost i.e. fixed cost = 17000

- Variable Cost:

In this system the only variable cost is battery replacement cost.
As already mentioned, lead acid batteries are having a life of 1200 cycles. Generally a car uses 250 days of a year. Then battery replacement is required after 2 years or after 30,000 km of run. Generally battery has a 40% resale value. Hence battery maintenance cost is Rs 2000 on 30,000 km use.
The charging cost of battery is 1000 ₹ per 2 years in severe condition.
Total cost = Fixed cost + Variable cost = 17000 +1000 =18000

BREAK EVEN POINT ESTIMATION

Assuming a car travels 10000 km Mileage : with AC 16 km/litre Without AC 20 km/litre

With AC = 10000/20 = 500

- Suppose petrol price is 74 ₹
- So 500*74 = 37000 ₹

Without AC = 10000/16 = 625 liter

- Suppose petrol price is 74 ₹
- So 625*74 = 46250 ₹

Now the difference will be 9250 ₹ per 10000 km .
" So our BREAK EVEN POINT will be attended at 20000 km"

VII. LITERATURE SURVEY:

**1)** Impact of Vehicle Air-Conditioning on Fuel Economy :- Author: - R. Farrington and J. Rugh

The air conditioning system is the single largest auxiliary load on a vehicle by nearly an order of magnitude. Current air conditioning systems reduce the fuel economy of conventional vehicles, thus incremental improvements can have a significant near-term benefit because of the large number of new cars sold each year. For high fuel economy vehicles, current air conditioning systems have a completely unacceptable impact on fuel economy. For example, conventional air-conditioning loads can reduce EV range and HEV fuel economy by nearly 40% depending on the size of the air-conditioner and the driving cycle. The peak cabin soak temperature must be reduced if a smaller air-conditioning system is to be used. Advanced glazing and cabin ventilation during soak conditions are effective ways to reduce the peak cabin temperature.To fully understand the thermal impact of vehicle modifications, effective modeling and testing must be conducted. We are continuing to investigate advanced glazing and ventilation techniques, but it is apparent that great opportunities exist to improve EV and HEV performance while reducing fuel consumption and improving air quality. A significant benefit could be achieved if the Federal Motor Vehicle Safety Standards were modified to allow lower transmissivity for glazing behind the front seats in all light duty vehicles and if transmissivity requirements were measured parallel to the drivers eyesight and maintained at current levels in that direction.It is clear that significant reductions in automotive auxiliary loads are needed, making tomorrow's vehicles safer, quieter, and more fuel efficient, while making passengers comfortable more quickly. New U.S. emissions standards are also providing the impetus for evaluating new climate control designs and approaches Vehicle climate control loads can be reduced in many ways-some of which can be readily implemented in today's vehicles and others that will require more development. Increasing vehicle efficiencies and decreasing polluting emissions will go a long way toward achieving the national and global goals of reduced dependency on foreign oil and improved air quality.

**2)** Solar-powered air-conditioning system for vehicles :-

Author: - Wilfred Lai

Publisher: - The Hong Kong Polytechnic University
Motorists are so used to turn on the engine for air-conditioning. Our solar-powered air-conditioning system for vehicles (SAV) will break this convention. Featuring photovoltaic technology and intelligent power control, SAV switches on- board air-conditioner to solar power when petrol engine shuts off, and the switch-over is automatic

and seamless. Principal investigator of this project Prof Eric Cheng explained, "Drivers of minibuses or taxis can now switch off the engine but continue to stay cool while waiting for passengers at the station. In fact, our system helps extend the operation of air-conditioner for two more hours." Prof Cheng further stressed that this device can also give good power output even during cloudy or rainy days. Similar to a big solar charger, this system has solar photovoltaic panels on the rooftop of the vehicle to collect power for storage in a battery to support a stand-alone electric air-conditioning unit when the car engine is not running. The solar panel is made from bendy materials which can fit perfectly on any vehicle rooftop, giving it a sleek appearance. It also serves as a good thermal insulation for the interior and other valuable equipments inside the vehicle. Idling not only pollutes the air, but is also bad for the engine as it may contaminate engine oil and accelerate the deterioration of engine components due to higher operational temperature and unnecessary prolonged operation. According to recent statistics, leaving a vehicle on idle for as short as 10 minutes a day will consume an average of 100 liters of petrol in one year. In other words, adopting our SAV can help save drivers' petrol and fuel cost. PolyU's President Prof Timothy W. Tong hailed the device as a practical solution that could benefit thousands of professional drivers and pedestrians in the city. The installation of our SAV on a Swire Coca-Cola Hong Kong truck was first announced in October last year. A series of testing on the road have proven the system robust and effective. To make another milestone on the road to green transport, the system is now being widely deployed in public transport such as minibuses and taxis, as well as some commercial vehicles including an operation truck of the Airport Authority Hong Kong. "We look forward to having more fruitful collaboration with Green Power Industrial Ltd and other industrial partners to build a low-carbon city. Together, we can jointly make a contribution for sustainable development of our community," said Prof Tong. As part of an on-going mission in advancing technology that safeguards natural resources and our ecosystem, SAV is the latest from a stream of PolyU's green innovations with an aim to reduce harmful emissions and eliminate the effects of climate change. This system has also brought home two international awards from the 39th International Exhibition of Inventions of Geneva in April this year. This accolade will certainly serve as recognition of the hard work, the know-how and the dedication that PolyU researchers have put in creating meaningful innovations that move us towards a sustainable society.

CONCLUSION :

We have concluded that by innovating our Ac system we can decrease engine load, fuel consumption, and also increasing human comfort.

FUTURE IMPLEMENTATION

1) Increasing HP of dc motor we can get the desired output.
2)Increasing the specification of solar panel.
3)We can easily install this system in bus.

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