

Prototyping Presentation for Hackathon

Deriving Energy from Exhaust of Car

Team: Enigma

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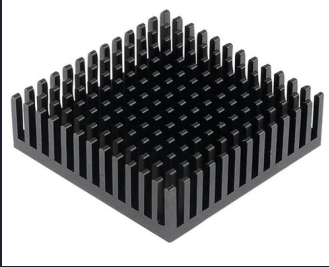
Institute: IIT Jodhpur



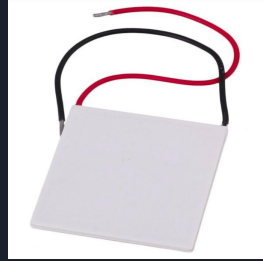
What is purpose of deriving Energy from Exhaust of Car?

- To replace the electricity with the non conventional energy resource harvesting methods.
- About two-third of the energy generated by a conventional power station is actually lost in the form of waste heat that escapes out of a cooling tower.
- Part of the problem is the gas or steam powered turbine systems that we use to produce most of our electricity work upon first burning of fuel to produce heat energy and converting the heat energy into mechanical energy and turning the turbine, and converting the mechanical energy into generator.
- This process is intrinsically wasteful, only about one third of the energy unleashed from the fuel actually ends up in the wire leaving the power station.
- If we could make an end of the wasted heat and could convert it into usable electricity, this would make the power generation much more efficient.

Equipment Required



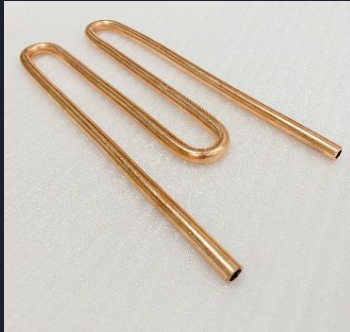
Heat Sink



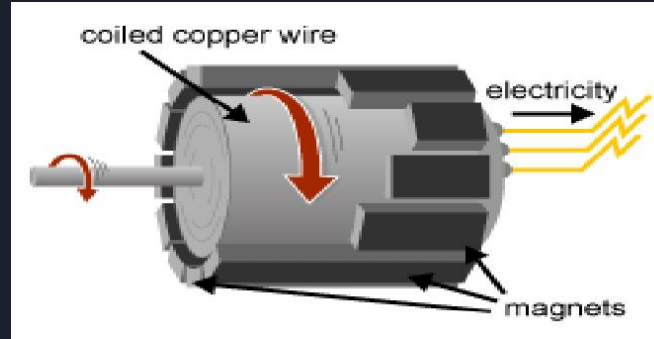
TEP Module



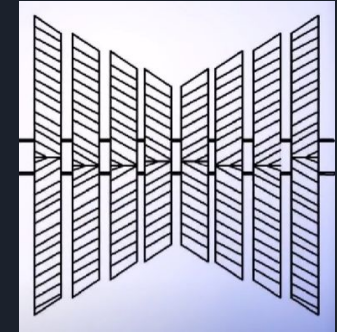
DC 5V Cooling Fans



Small Copper Pipe



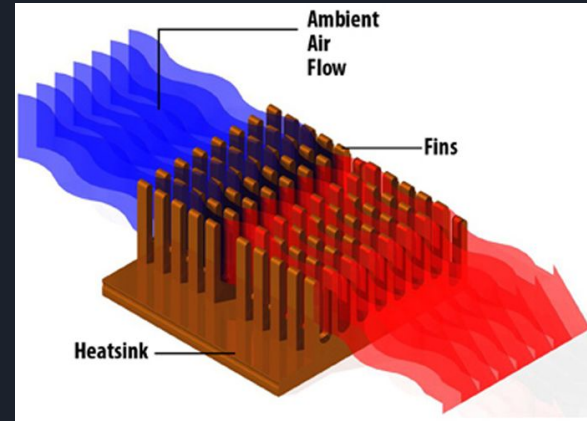
Dynamo



Triangular Turbine

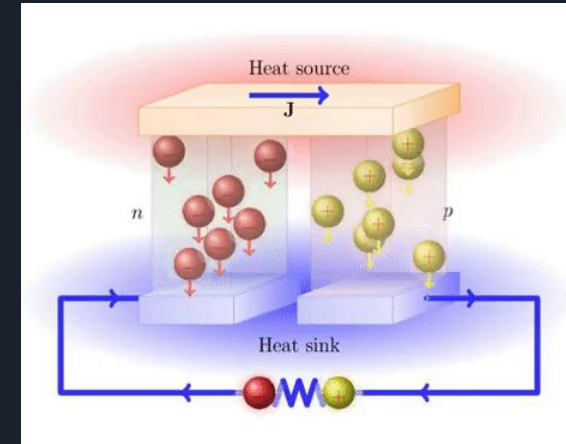
Heat Sink Material, Size, Costing

- To extract heat energy, we need material whose thermal conductivity is high.
- To manage cost of product we need material which is easily available and easy to manufacture.
- Al is one such material satisfy above properties.
- Also it is lightweight.
- Heat sink size : 132 x 132 x 10 mm has cost about Rs.150 in market and size may vary according to size of exhaust.



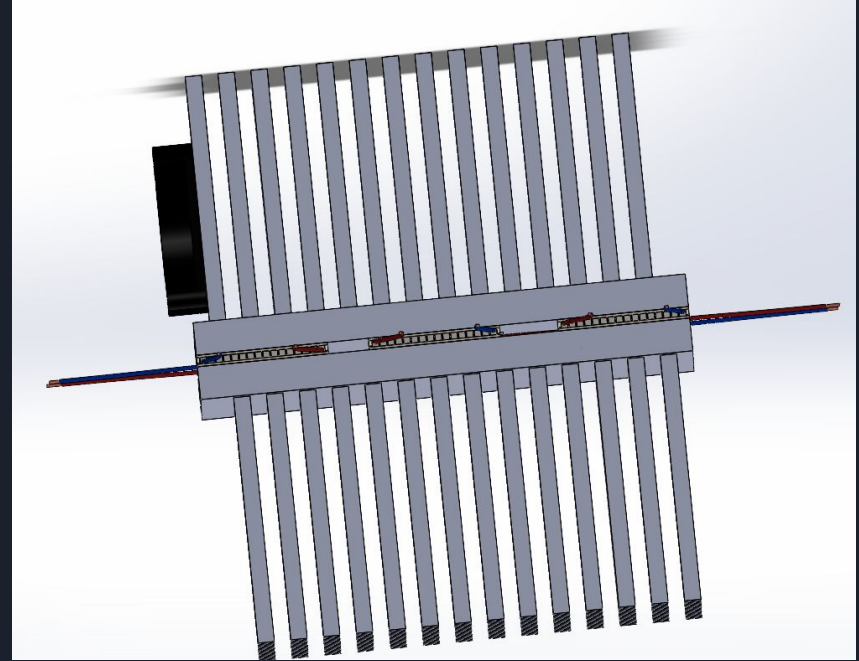
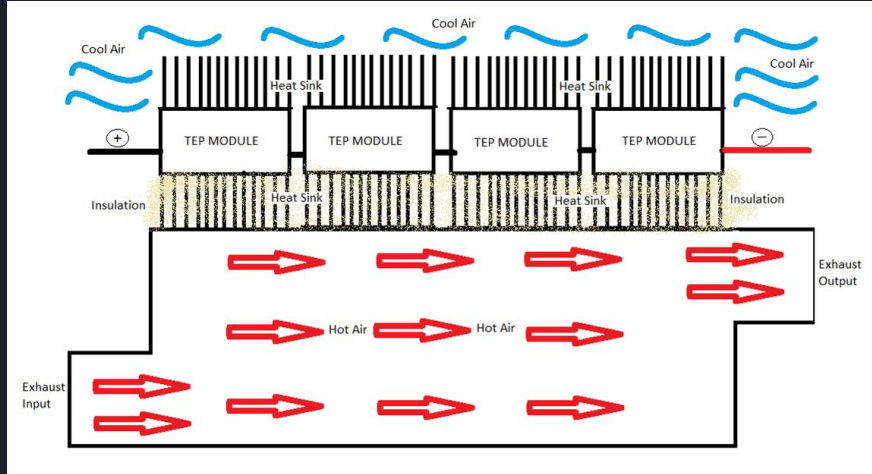
TEP Module

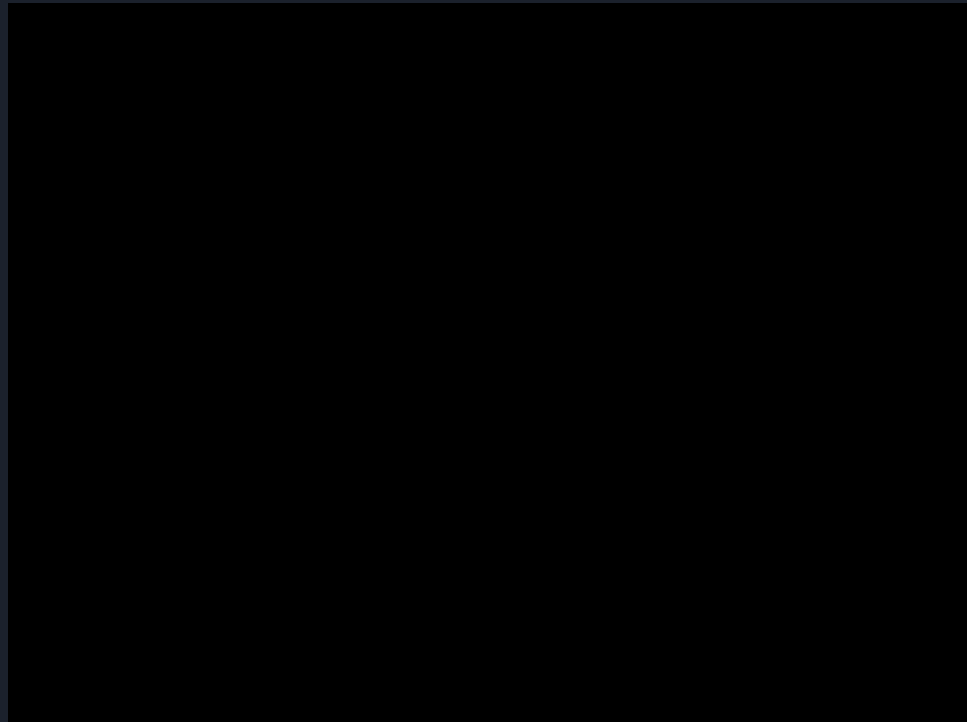
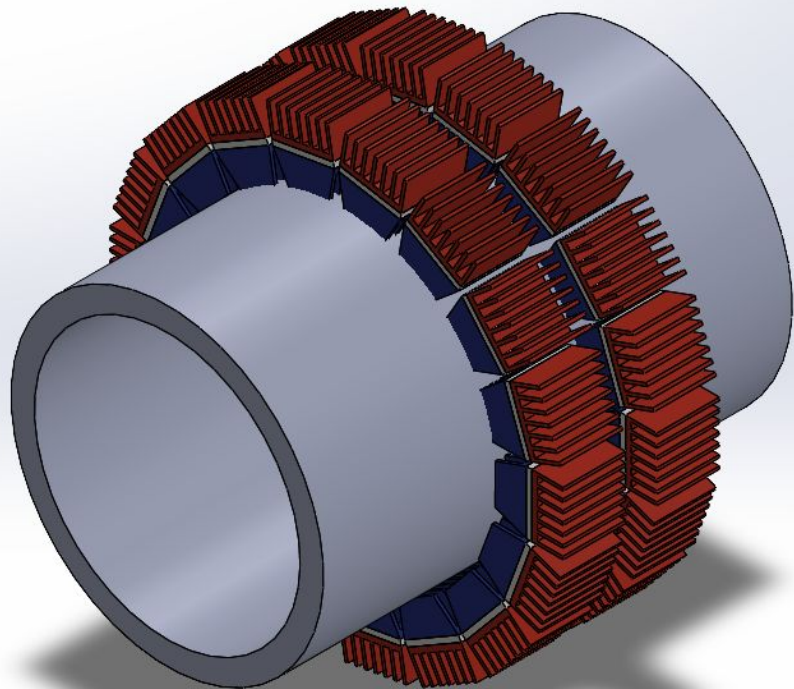
- The TEP module is Bi-Te based thermoelectric module that can work at the temperature of as high as 330 Degree C (626) heat source continuously, and up to 400 Degree C(752) intermittently.
- The Peltier effect is the cooling of one junction and the heating of the other when an electric current is maintained in a circuit of material consisting of two dissimilar conductors; the effect is even more substantial in circuits containing dissimilar semiconductors.
- These elements work on the Seebeck effect in which the difference between two dissimilar electrical conductors or semiconductors produces a voltage difference between the two substances.
- Peltier modules can run on the latent heat generated by the candles or campfires and on the other side heat sink or chilled water/ice can be used for heat dissipation. By providing heating on one side and cooling on the other side a temperature difference is created which plays an important role in voltage generation.



Device Display

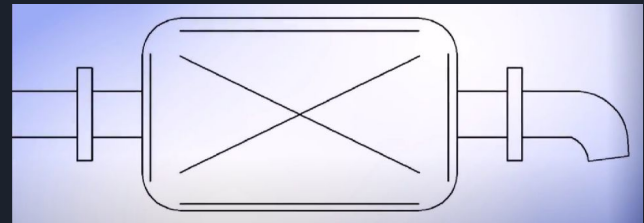
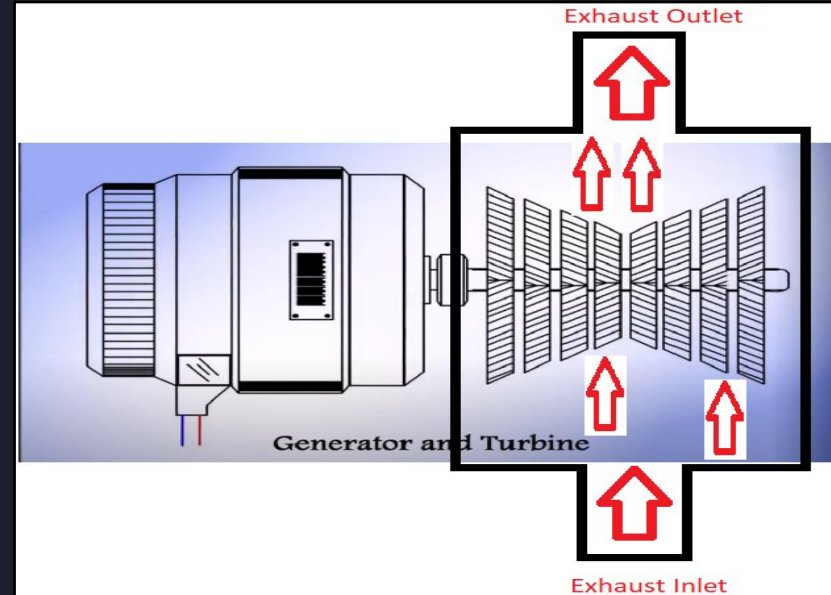
We have created a 3D model for the device which we have proposed. Now we will have a look into it





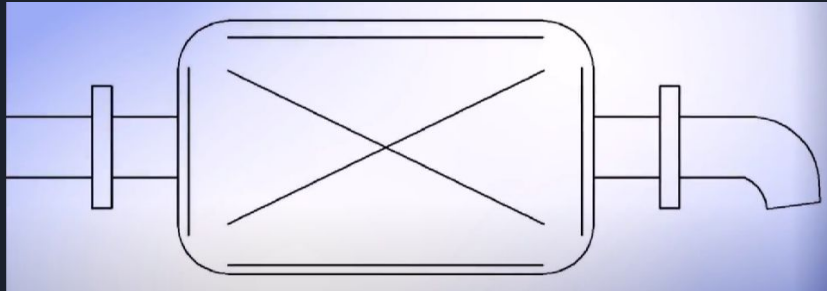
Secondary Device

- A double triangular turbine can also be introduced inside the exhaust to generate voltage to convert the energy of fluid flow into rotational energy.
- Turbine is positioned close to silensor's inlet.
- A dynamo is also connected to convert the rotational energy into electrical energy.
- With the increase in the flow rate of exhaust gases, power output will also increase



Supporting Discussions

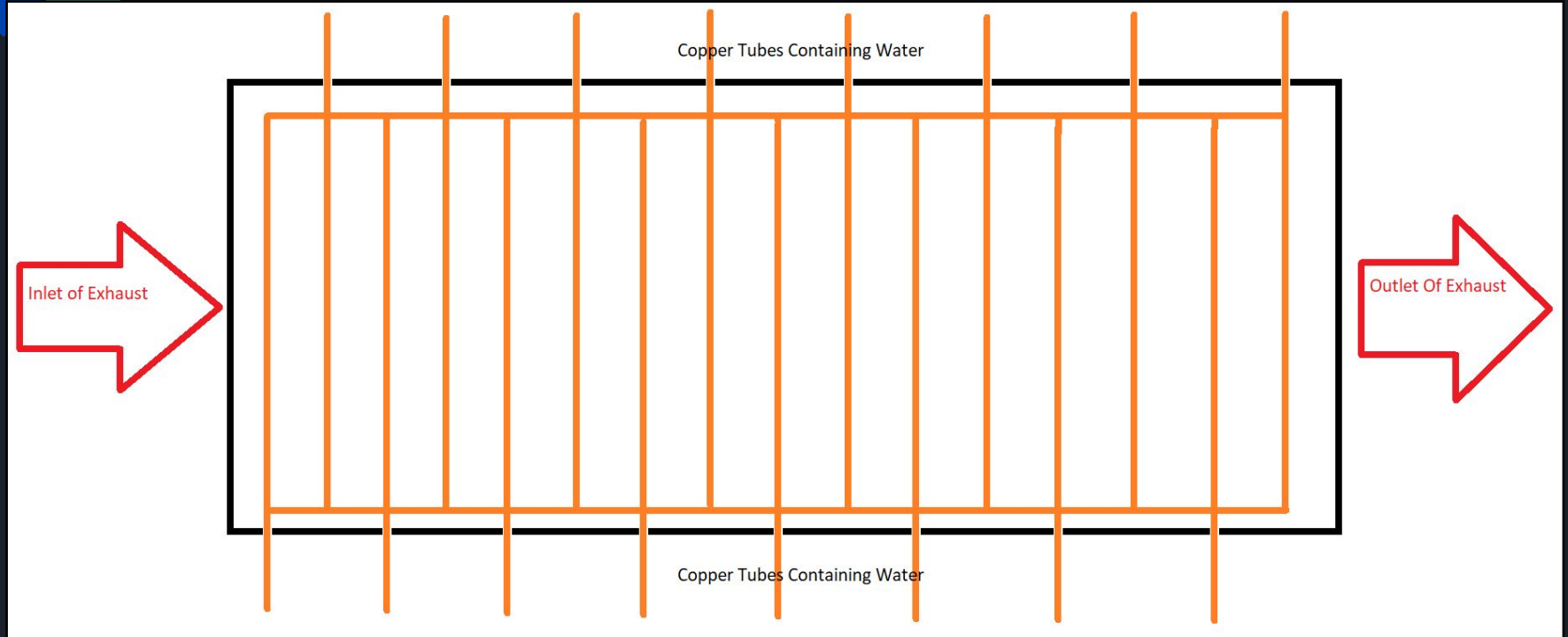
- When we are using a combination of both the proposed devices we can increase our efficiency as the maximum efficiency we can achieve in laboratory is around 55%
- When we are placing this device inside an exhaust where temperature is around 500°C to 700°C and when the vehicle moves due to external air flow the temperature outside drops down around 25°C to 30°C .
- We are using heat sinks to evenly distribute temperature difference over the Peltier module between the two sides.
- When the vehicle is at stand still position the efficiency drops as external temperature increases.





Future Applications

- Thermoelectricity phenomenon is used in various sector.
- The Peltier element are rising strongly the last couple of years because of the positive development in the semiconducting industry past decade.
- Big organisations, like NASA and DOD(Department of Defence in the US) have set up development programs on a large scale to develop and improve the Peltier elements.
- Peltier elements are quiet and free of vibrations as they don't contain moving parts.
- To generate electricity from a large engine.
- By introducing copper pipes into the exhaust pipes containing water, so the exhaust gases can warm up the water and convert it into steam which can be further used to rotate turbines.
- **There inertia can be used to rotate a dynamo. Only in very big engines where there is room and a sufficient amount of heat is generated this setup can be used.**





THANK YOU