Theme: Sustainable track

Peltier Power

Peltier magic turning heat into opportunity.....

Team EcoPowerGen_Innovators

Abstract:

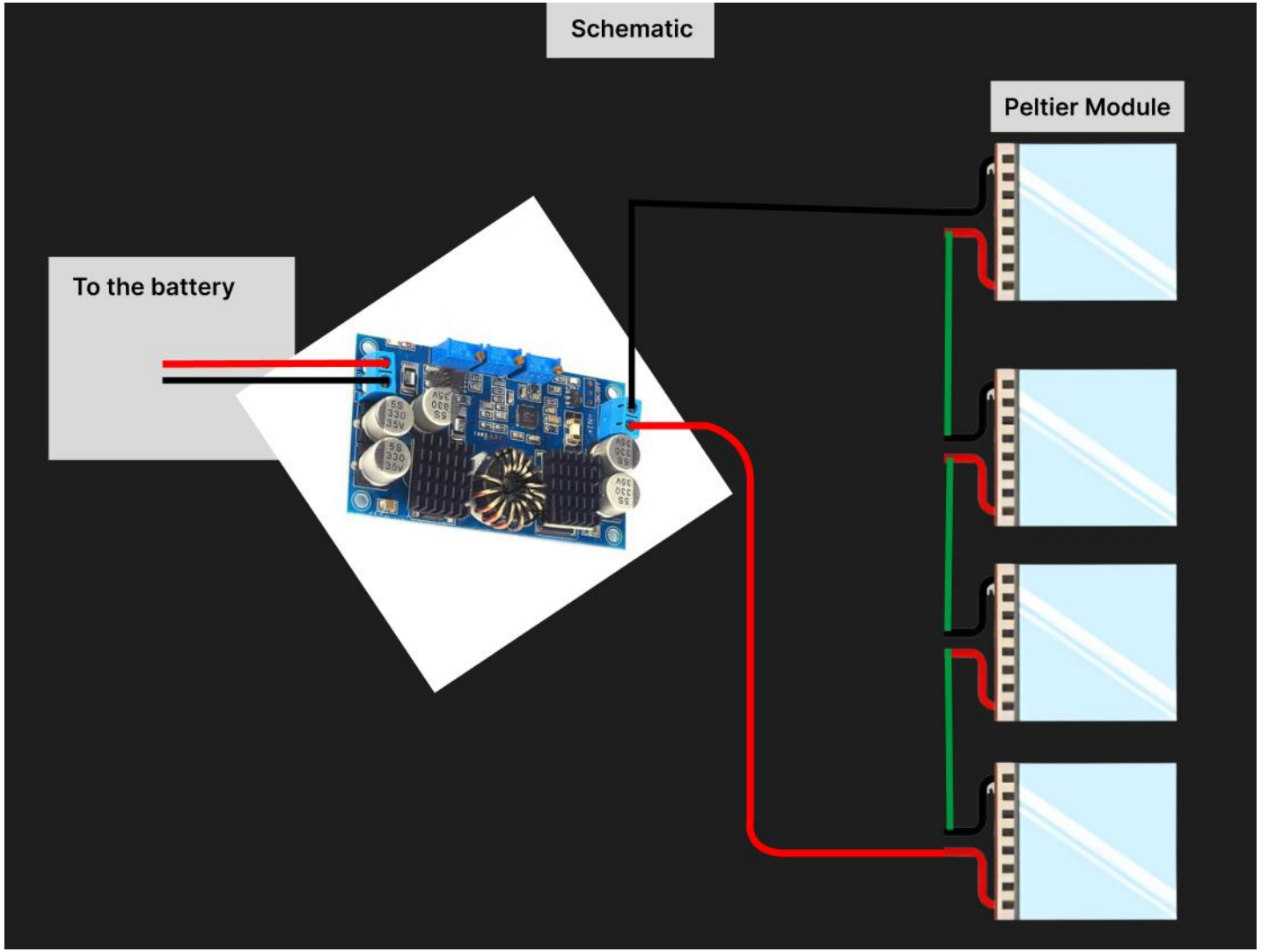
This abstract explores innovative approaches to harnessing waste heat for the generation of electricity, offering sustainable and energy-efficient solutions to address both environmental and economic challenges. As the world faces increasing energy demands and concerns about climate change, the conversion of waste heat into electricity presents a promising avenue for reducing greenhouse gas emissions and maximizing energy utilization.

This paper discusses various methods and technologies for waste heat recovery and conversion, including thermoelectric generators, organic Rankine cycles, and advanced heat exchanger systems. The feasibility and efficiency of each approach are evaluated, taking into consideration the specific characteristics of waste heat sources, such as industrial processes, automotive systems, and data centers.

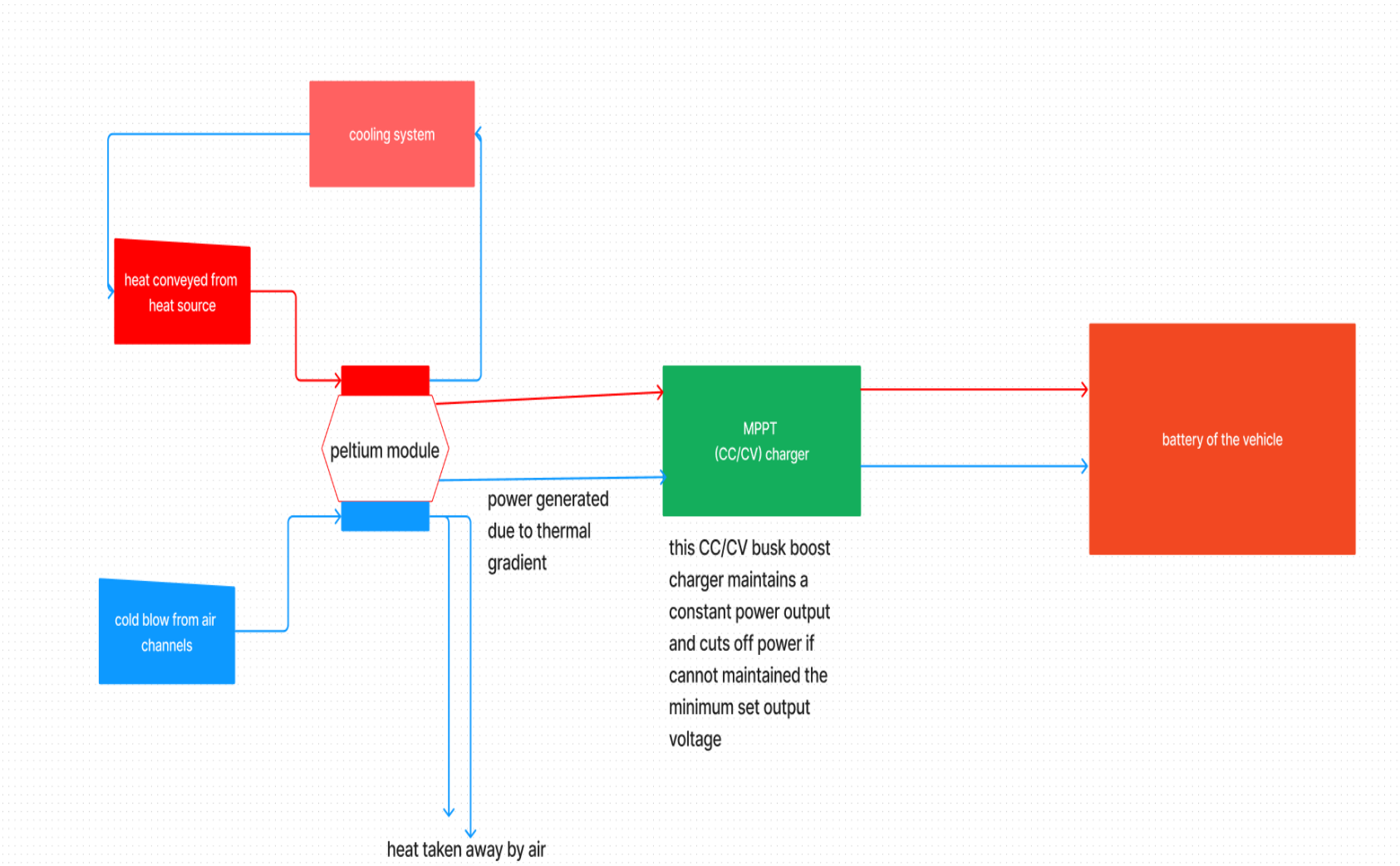
Furthermore, the abstract highlights the importance of integration with existing energy systems and the role of policy incentives in promoting the adoption of waste heat recovery technologies. The potential benefits of these innovations extend beyond electricity generation, encompassing enhanced energy sustainability, reduced operational costs, and reduced environmental impact.

Ultimately, this abstract encourages further research and development in the field of waste heat recovery and conversion, emphasizing the potential for these technologies to play a pivotal role in the transition to a more sustainable and energy-efficient future.

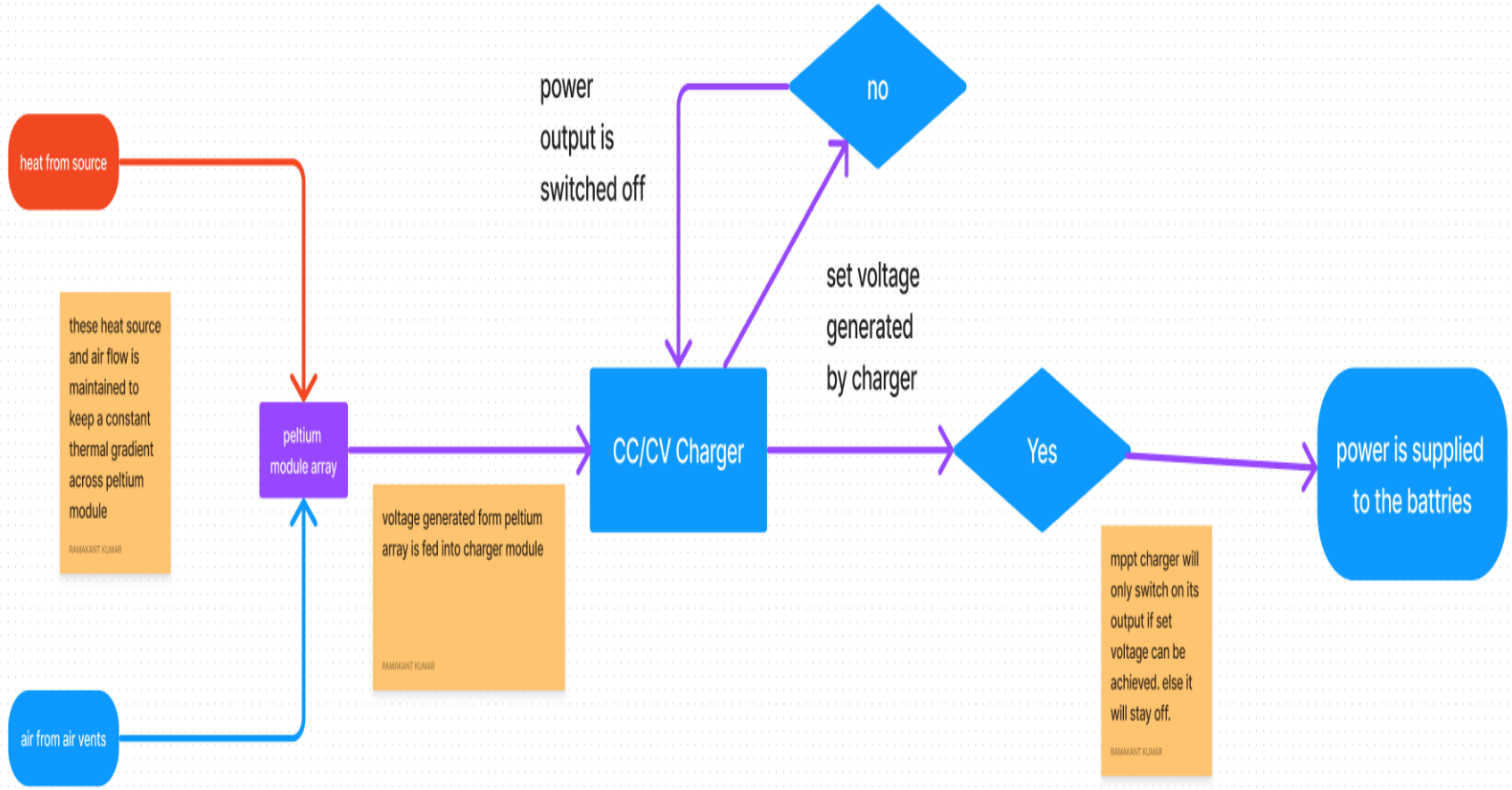
Architecture and Schematic Layout:



Design flow diagram:



Flow Chart:


heat from source
these heat source and air flow is maintained to keep a constant thermal gradient across peltium module
RAMAKANT KUMAR
air from air vents
peltium module array
voltage generated form peltium array is fed into charger module
RAMAKANT KUMAR
CC/CV Charger
power output is switched off
no
set voltage generated by charger
Yes
mppt charger will only switch on its output if set voltage can be achieved. else it will stay off.
RAMAKANT KUMAR
power is supplied to the battries

List of all the essentials

List out all the essentials (components, tools, software, data, etc.) that you are going to use in order to solve the problem statement. Also provide the complete technical details.

List of essentials	Technical specifications
Thermal tape	This is thermally conductive double side adhesive tape which is a very food alternative for projects like this
Peltier module	**TEC1-12706** Working Temperature:-55℃ to ﹢80℃ Vmax:15.4VDC Imax:1.2A(15.4VDC
Mppt charger	**LTC3780 Automatic Step-Up Step-Down Boost Buck Module** - Input voltage: DC5-32V, it is recommended to use the voltage above 10V - Output voltage: DC1V-30V continuous adjustable; default 12V delivery; - Output current: 10A (MAX) for a long period of time, the default 4A delivery; - Output power: long-term 80W, peak 130W, more than 80W, please strengthen cooling; - Output ripple: 50mV (12V to 12V, 5A measured); - Input back protection: No, if required, please contact the input side of the Schottky diode in series; - Output: No, such as anti backflow need to charge, please at the output series Schottky diode; - Temperature range: -45°c~ +85°c; - Size: 77.6*46.5*15mm - Short circuit protection: Yes
Heat sink	**40X40mm**

Validation Steps:

Temperature gradient should be 30 degree approx	The temperature difference between the two sides of the module needs to be maintained about 30 degrees to get max output
External cooling	Opposite to the heating side there needs to a heatsink to be attached for better cooling
Make connections as per schematics	Connect the Peltier modules in series to increase voltage output

Assumptions List:

List of Assumptions	Justifications
Linear increase in power output	Being a temperature dependent device we have assumed it's power output increase linearly as the temperature difference increases between the two surfaces.
Temperature difference is maintained	As the most efficient temperature difference is 30degrees so it is assumed that this temperature difference is maintained throughout.
No loss in stacking the modules	We have considered the modules similar to a battery and hence neglecting the internal resistances and power loss on stacking them.

Record of test results:

S.No.	Number of modules	Temperature difference (C)	Voltage output (V)	Current output (mA)
1	1	30	4.41	148
2	2	30	8.06	280
3	3	30	11.6	364
4	4	30	15.3	413

Generating power from the passive wheels of the vehicle by using the concept of axial 3-Phase generator:

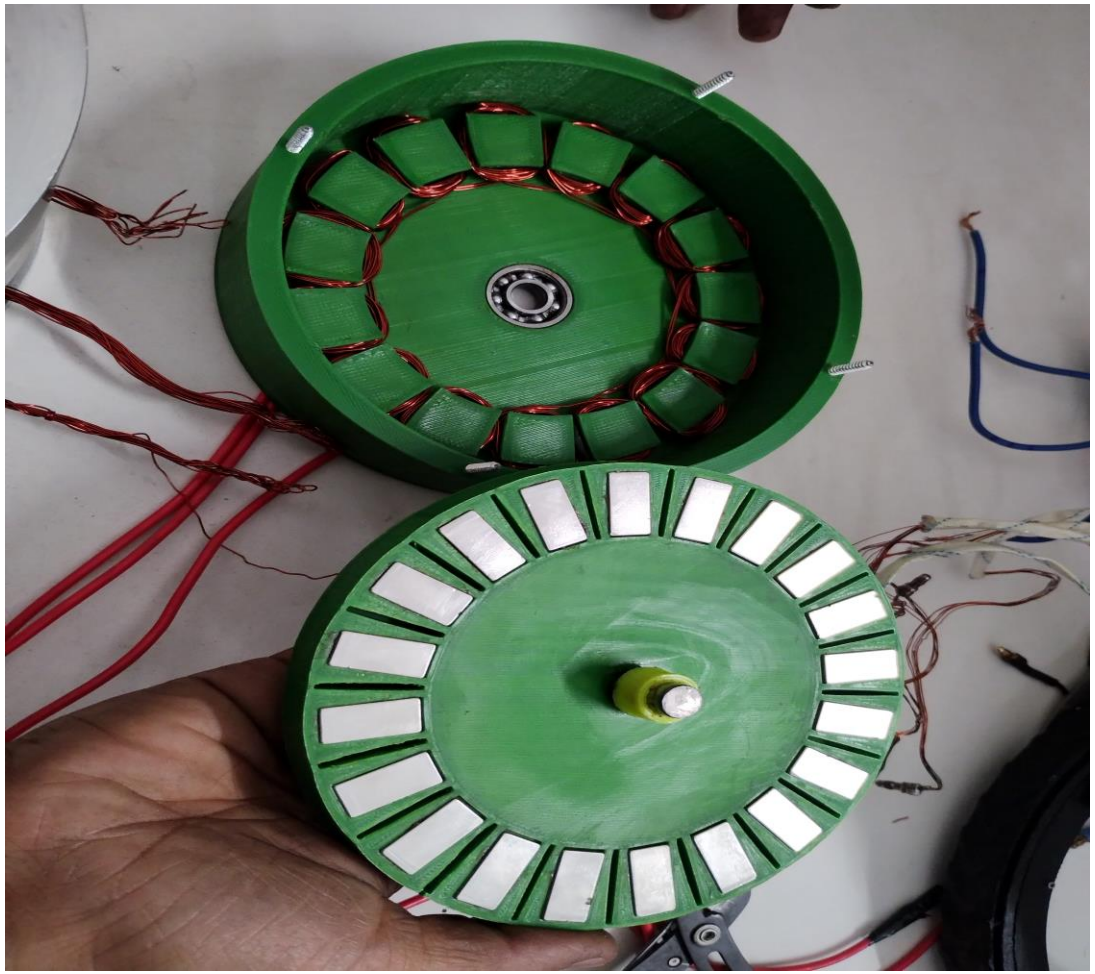
To harness the rotational power of a vehicle's wheels, an arrangement of magnets are applied into the wheel assembly. As the wheels rotate during normal operation or deceleration, the magnet start acts as a generator, converting this rotational kinetic energy into electrical energy. The generated electricity can be stored in a battery or used to power vehicle components, enhancing overall energy efficiency and reducing reliance on the primary power source. Optimizing the integration and design of the axial flux motor is crucial for efficient electricity generation from wheel rotation, promoting sustainability in transportation.

3-D model of the concept:

Reference link: https://www.emworks.com/application/design-and-simulation-of-a-3-phase-pm-axial-flux-generator-for-wind-turbine/3d

1st Developed Prototype:

This prototype is developed for the testing purpose.



Thank You…

MetroHacks'23