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Research Article

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Regeneration of Energy through Wheel Rotation in Electric Vehicle

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Abstract Proper utilization of waste energy can mitigate energy crisis and keep the cost under control. This project aimed to regenerate the energy from rotating wheel in the vehicle. In this study, a prototype electric regenerative system is designed and tested experimentally to predict its performance. The prototype system is operated by a 12V motor that can recharge a 12.0V battery. During the experimental test, when normal speed is applied to test the time required for storing 0.84W into the battery. The results show that the battery is recharged up 8.0V to 9.0V at the time of rotation of 0.8sec with the maximum load of 4.5kg with the help of voltage booster it increases the output voltage and recharged by 6.0V at the minimum speed with 4.0kg. It is observed that the amount of energy stored in the battery is increased with the increasing speed of rotating wheel. This energy can be used for operating auxiliary components such as fans, lights etc. and in cases, added to the main power source. In a nutshell, this project has brought the totally unused energy during rotating wheel of vehicle in the limelight and paved the way to utilize this energy in a fruitful manner.

Keywords Electric vehicles (EVs), Voltage booster, Rotating wheel, solar panel, Regenerative system

Nomenclature

V	Voltage (volt)	N	Size Factor
T	Time (sec)	T	Torque(Nm)
R	Resistance (ohm)	C	Capacitor(C)
Q	Charge (coulomb)	V	Velocity(m/s)
P	Power (watt)		

Introduction

Energy is the fundamental needs in the modern era. Energy is directly linked to the well-being and prosperity across the world. Nowadays, the world is totally dependent on an abundant and uninterrupted supply of energy. As the sources of the conventional energy are not long lasting, so almost every sector including the transport sector is concentrated on the renewable sources of energy such as solar, wind, geothermal, tidal, biomass etc. Even the energy conversion from the waste materials such as pyrolysis is a good weapon to fight against the growing energy demand Also, it cannot be denied that during the energy conversion a handsome amount of energy is wasted in vain. This wasted energy can be a good source of energy generation, which will be helpful to recover the energy demand. In the transport sector, lots of energy is wasted without any recycling. Energy loss due to rotating wheel is one of them. Running an automobile vehicle's motion requires a power to run a vehicles, Mechanical energy changed to the electrical energy due to the rotation of moving wheels by using magnetic field.

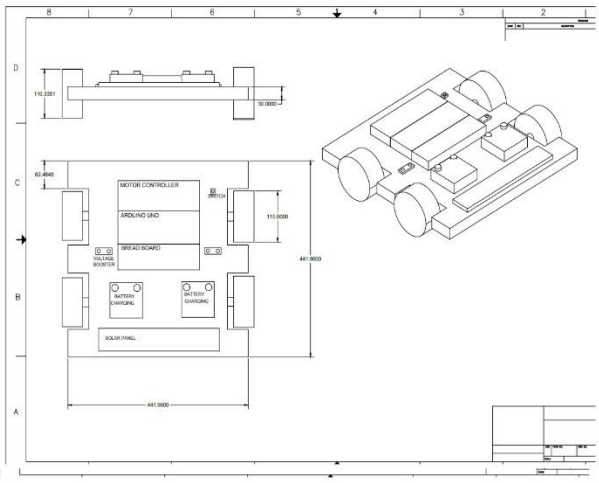

Figure 1: 2D view

It is essential to remember that HEVs do not operate entirely emission-free since they still need fuel-based power sources. In contrast to cars that only use internal combustion engines, they are more ecologically friendly. The use of hybrid technology has opened the door for future developments that may use alternative fuels, lowering reliance on conventional fossil fuels and further reducing exhaust gas emissions. The issue of global warming and climate change is getting increasingly urgent as a result of the quick progress of contemporary society and cutting-edge technology. As a result, there is an increasing emphasis on creating technologies and engines that use alternate fuels. Electric car manufacturing is currently a top priority for automakers, who are continually experimenting with a wide range of ideas and prototypes. In order to incorporate alternative energy sources like natural gas, hydrogen, and biodiesel in the near future for the benefit of society, extensive study is being done on these sources.

Literature Review

A hybrid car combines the use of internal combustion engines (IC engines), at least one electric motor, a battery, and either an electric generator or an electric motor. The wheels of the vehicle may now be moved either collectively or separately thanks to this integration. In order to achieve higher efficiency than conventional internal combustion engine (ICE) vehicles while also providing better cost-effectiveness and range than fully electric vehicles, hybrid vehicle development requires the integration of mechanical, electrical, and electronic technologies. In order to improve fuel and battery economy and decrease emissions compared to traditional cars, such a vehicle requires the integration of electrical, electronic, and mechanical technology. According to current study, a model that optimizes the design of a car with a 100-kWh battery, a 135-kW generator, and a range of 130 miles shows a decrease in fuel consumption of at least 15%. The battery and engine work together to maintain the same power output even when the engine is smaller. The only way to boost efficiency by 15% is by combining a 100-kWh battery with an engine. In comparison to a conventional engine of the same size, a hybrid electric vehicle (HEV) relies on both an internal combustion (IC) engine and an electric motor for optimum efficiency and lower emissions.

This research focuses on new developments in plug-in hybrid and electric cars, which help to create cutting-edge gear train systems. For common IC engine based hybrid cars, the article analyses hybrid designs, engine strategies, electronic control units (ECUs), electric motors, and energy management. Future trends and various tactics are analyzed through data analysis and critical assessment, with the goal of advocating HEVs as a solution for short- and medium-distance transportation needs with low fuel usage. HEVs are the finest suited answer in such situation since they are especially suitable based on the emission control limitations established by the Indian government. The goal of global optimization techniques is to find the global optimal solution, however because they demand a lot of computing time, they can't be used in real-time. Dynamic programming (DP), for example, is one of these methods that is frequently used as a benchmark for assessing other energy

management (EM) solutions. Instantaneous control techniques, in contrast, optimize more quickly and allow for real-time deployment.

A hybrid electric vehicles (HEV) performance is impacted by a number of factors, including road profiles. Ranking the significance of DC-dependent characteristics in terms of fuel efficiency is done using size reduction approaches built on multi-criteria optimization methods. A genetic algorithm (GA)-based intelligent power split methodology is then used to validate the outcomes. In summary, it can be seen that HEVs equipped with DC that is tailored to Indian urban road conditions get better fuel efficiency than those from other nations. Due to the favorable road conditions in India, the market for HEVs is expanding, which helps the country's economy while also lowering hazardous emissions. In order to maximize economy, this study covers the next generation of HEV gearboxes, which will change the engine speed at predetermined intervals rather than at a constant speed. This novel strategy, which seeks to maximize the vehicle's performance, is what propels advancements in HEV gearboxes. It was hoped that a method would be developed to optimize gear ratios in hybrid electric vehicles (HEVs). The finding is supported by an investigation of engine working distribution, multiple HEV models, and energy management techniques that take into account total efficiency. By directly operating the wheels, the recommended Direct Drive Assist (DDA) technique enables the engine to run in the high-efficiency zone. In contrast, rule-based solutions direct the engine to follow the efficiency profile's optimum path. The DDA approach was examined and contrasted with several HEV models. The overall cost of HEVs is cut by lowering the number of gears in the gearbox, increasing market share. It has been proven via examination of existing technology that HEVs considerably lower greenhouse gas emissions.

The article addresses the crucial initiatives and plans put in place by the Canadian government to encourage the use of environment-friendly automobiles, notably HEVs.

A brief overview of hybrid technology's history serves as the paper's introduction. The many technologies employed in the manufacture of hybrid vehicles, including solar-powered hybrids and plug-in HEVs, are also covered. The purpose, limitations, effectiveness, and case studies of commercial hybrid vehicles like the Astrolabe and Toyota Prius series are examined in this essay.

Methodology

The Regenerative energy systems vastly improve the fuel economy and further enhance the attractiveness of the vehicle. There are so many methods of regeneration of energy such as from braking system (a) Electric Regenerative braking system (RBS), (b) Hydrostatic Regenerative Braking (HRB), (c) Regenerative Braking Using Compressed air

Table 1: Material Selection of Electric Hybrid Vehicle

S. No.	Name of Component	Dimensions	Material used	Material specification
1	Frame	Length- 3.5-4.5m Width- 1.5 - 1.8m Height- 1.4 -1.7m	wood	Cheap, durable, good strength
2	Motor terminal	12mm or more	Copper, brass. etc	Depends upon motor power requirement and other factors
3	Capacitor	6.3*11.0mm	Steel, aluminium. Etc	Based on manufacture specification and choice of engineering.
4	Voltage Regulator	30*5*10mm	Semiconductor-silicon or gallium arsenide Capacitor-ceramic, aluminium	Depends upon specific design and power requirement
5	Wheel	115.30mm	Rubber	For friction purpose
6	Solar	10*8*9mm	Silicon	Capture the sun’s energy and convert it

				to electricity
7	Battery	8*7mm	Steel and mix. Of zinc	A dry cell primary battery that directs electric current from the electrochemical reaction
8	Dc Motor	5*6mm	Plastic	Light in weight, durable
9	Wire	-	Galvanized iron	Copper, aluminium
10	Arduino	-	fiberglass epoxy material known as FR-4.	Fiberglass epoxy material
11	Battery charging circuit	-	-	Cheap, durable, good strength
12	Toggle switch	12*10mm	Metal component – provide durability and mechanical strength	Metal, insulation,

Total Estimated cost is up to Rs 6000 approximate.

What is PCB?

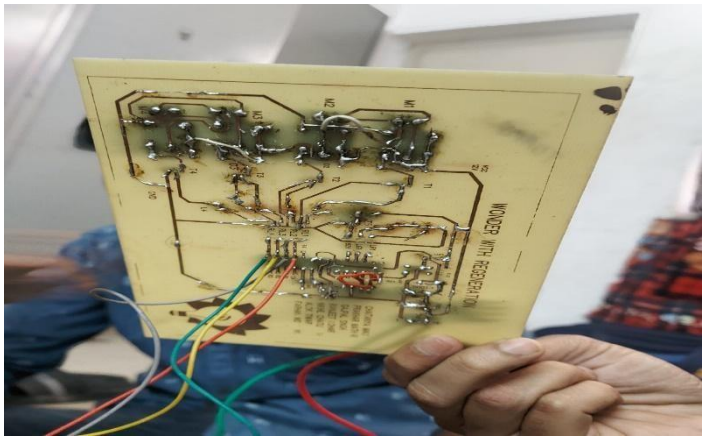

Figure 2: Printed circuit board

PCB stands for Printed Circuit Board. It is a board made of insulating material with conductive pathways etched onto its surface. The purpose of a PCB is to provide a platform for electronic components to be mounted and connected together.

The conductive pathways, also known as traces, are usually made of copper and are designed to carry electrical signals between the components on the board. The PCB is also used to provide power to the components and to ground them. PCBs are used in a wide range of electronic devices, from small gadgets like smartphones and tablets to larger**.**

Design and Construction

As I said the construction of this model is very simple. The main components of the designed electrical vehicle are an PCB, voltage booster, Electric motor controller, Wheels etc.

The cardboard is designed in a well manner to brings coordination in a balancing and provide design a way to restrict air friction. PCB is designed and construct to reduce complicated all component that are placed or attached to model.

The PCB design made in some steps that are:-

Firstly, Etching process that about 10-15min then cutting process and then dip tress process, press process on glass epoxy take 15-20min and identifying any defect present in PCB. After PCB circuit design completed all required component are get attached to PCB.

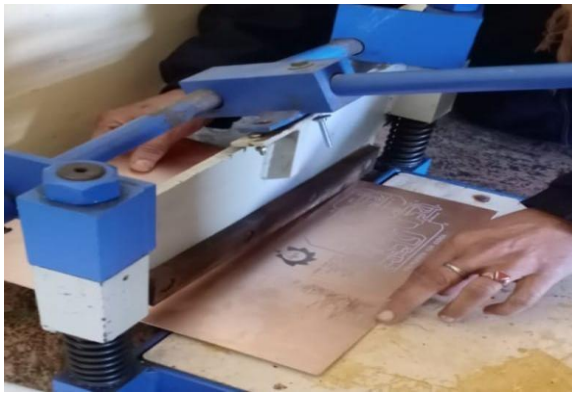

Figure 3: Cutting process

Figure 4: Etching Process

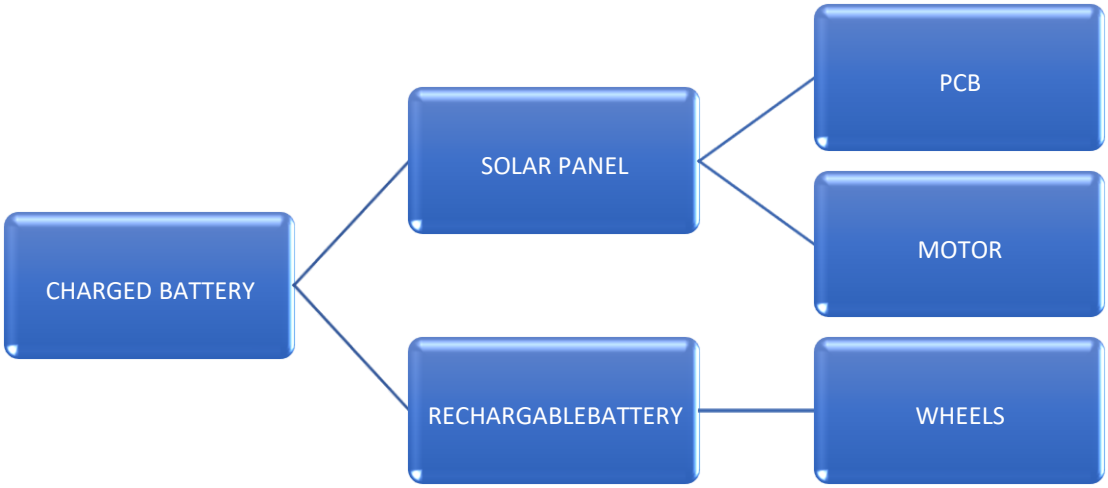

Figure 5: Circuit Design

Power Transmission

Electrical, electronic, and mechanical components work together to provide controlled movement in an automobile that moves utilizing a remote controller PCB circuit. By delivering signals to the PCB circuit, which processes them to control the motion of the automobile, the remote control serves as an input device. The remote control sends out electrical impulses in response to pressing a button or moving a joystick.

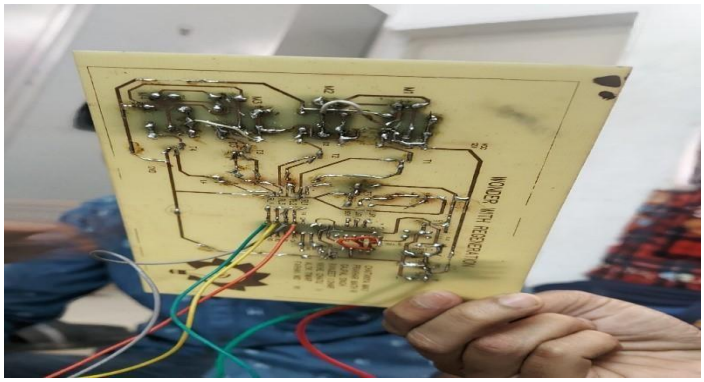

Figure 6: PCB

The PCB circuit of the automobile is then connected to these electrical signals. The core control component, known as the PCB or printed circuit board, receives and processes signals to carry out the intended operations. The PCB's microprocessor is in charge of catching and decoding the signals sent by the remote controller. It interprets the instructions and produces output signals that regulate the motors or actuators on the automobile. These output signals are supplied to the motor drivers or servo controllers, which then provide the motors or actuators with the required power and control signals.

In conclusion, the transfer of electrical signals from the remote controller to the PCB is how a car that moves using a remote controller PCB circuit function. The PCB's microprocessor decodes the inputs and produces output signals that regulate the actuators or motors. The automobile may then move in response to the user's orders thanks to the motors or actuators. The car's performance might be improved by adding more sensors.

Figure 7: Prototype Model

Conclusion

In this study, a prototype experimental electrical vehicle is successfully designed and tested to study the energy regeneration for rotating wheel. Analyzing the results, the following conclusions are drawn: a. The battery is recharged by 0.90V at the normal speed at load of 4.5kg with the help of voltage boosters. At the minimum load of 2.5kg. the battery is recharged by 12.0V approximate. It is investigated that, the amount of energy stored is increased with the increasing of the vehicle speed. b. The at the minimum RPM. The study also shows that the RPM is inversely proportional to the load. This study presented the proper potency of the regenerative wheel rotation system in case of utilizing the waste energy. A brushless dc motor is recommended as an efficient

choice for the further future work. In this voltage booster play a major role as it increases the voltage from low voltage to high high voltage. And this can be further use for any purpose like to store charge in battery, fan, light, etc. It purposes to save energy from wastage and reuse from them and free from any environment pollution.

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