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Development of Self Charging Electric Vehicles

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ABSTRACT—

Electricity is generated by regenerative motors which are installed on the wheels of car as the car starts moving from one place to another by a main motor which is connected to the rear axle as the main motor rotates, the rear wheels rotate and the car moves from one place to another by this movement and rolling friction the regenerative motors rotates and produces electricity. But according to the thermodynamics law and many other laws we cannot achieve 100% of energy from one source to another and it is theoretically impossible, so all we can improve is efficiency and that's the main point of this project. As we all aware of today's condition about the pollution created by the vehicles this is an effective way to improve our technology for our future. This project is aimed to develop a prototype of a self-charging Electric Vehicle.

Keywords— Self charge, Electric Vehicles, DC generator, Power measurement etc.

Introduction

Today we are generating electricity from fossil fuels, they are not environmental friendly. It causes global warming, therefore we need Non-Conventional sources of energy. A great part of the oil consumption is recently allocated to the transportation sector and a large portion of that is used by road vehicles. According to the international energy overview report, the transportation sector is going to increase its share in world's total oil consumption by up to 55% by 2030. In order to increase the energy a revolution in the transportation sector occurs. To reduce use of energy from fossil fuels in transportation usage and make environment clean and green, we have designed electric vehicle that uses solar energy and electricity to run[7]. The Photovoltaic cells used to harness solar energy to generate voltage to charge the battery.

An Electric Vehicle (EV) can be referred to as an electric drive vehicle, uses one or more electric motors or traction motors for propulsion. A few electric vehicles will emerge on the market that it can be powered by a rechargeable battery. The Battery Electric Vehicle (BEV) is mostly dependent on the battery technology[9]. It provides a level of comfort and ease of operation that could not be achieved by the gasoline cars of the time. However, in recent years, increased concerns over the environmental impact of gasoline cars, higher gasoline prices, improvements in battery technology, and the prospect of peak oil, have brought about renewed interest in electric vehicle, which are reported to be more environmentally friendly and cheaper to maintain and run.

Electric vehicles are becoming popular and more prevalent due to increased energy costs and concern regarding the reduction of greenhouse gas emissions. Electric vehicles are powered by batteries that are contained with the vehicle and usually provide a sufficient charge for the propulsion of the vehicle through city traffic. The batteries are mounted along with the vehicle and are used to run the vehicle. In addition to the solar, we can also use alternator to recharge the batteries. The alternator is connected at the midpoint of the back wheel. The rotational energy of the wheel can be converted into electrical energy by using generator and by which supply is fed to the batteries.

In this era conservation of energy is the most necessary part of the society and as automobile is an important part of society in day to day life, hence the conservation of energy as well as pollution due to the use of Bio-fuels in automobile sector is a challenging job. So energy conservation and pollution free vehicle became most important factor.

To solve this issue the concept of Electric Vehicle (EV) (electricity powered automobile) system was introduced, this can be used in all type of automobiles such as cars, bus; truck etc. But once the battery of EV is charged it travels a limited distance, again we have to charge the battery of vehicle, which is a time consuming process.

If one self charging EV is assembled using some kind of alternators with other circuitries, which can charge the battery simultaneously when it is moving, then the problem can be solved. We can use a single powerful battery or two batteries for this case.

Problem Identification

In a current scenario, the fossil fuels are depleting rapidly due to the over usage of conventional vehicles. Generally conventional vehicles use petrol and diesel as a main fuel. It causes heavy damage to our environment by emitting the harmful gases such as HC (hydrocarbon), CO (carbon monoxide), and Nox emissions which leads to ozone depletion and global warming. Also more number of alternative fuels such alcohol (methyl alcohol and ethyl alcohol), biogas, bio-diesel, natural gas and vegetable such as peanut oil, linseed oil, rapeseed oil, sunflower oil, etc can be used in order to replace the existing fossil fuel. But a proper cause and effects has not yet identified. Here the electric vehicle plays a vital role to boom the automobile to the next generation. The most of the electric vehicle uses battery as a major source of power. But main problem we identified is that the battery should be charged for a long period of time in a static condition only. It leads to consume more conventional power and so it increase the cost of the electricity used. And also recharging fuel stations are not sufficient as the process of recharging consumes more time. As the battery is continuously used to run the vehicle, deep discharge of battery is frequently occurring. So that the life cycle of battery is decreased. Due to this the replace cost of battery is high.

Proposed System

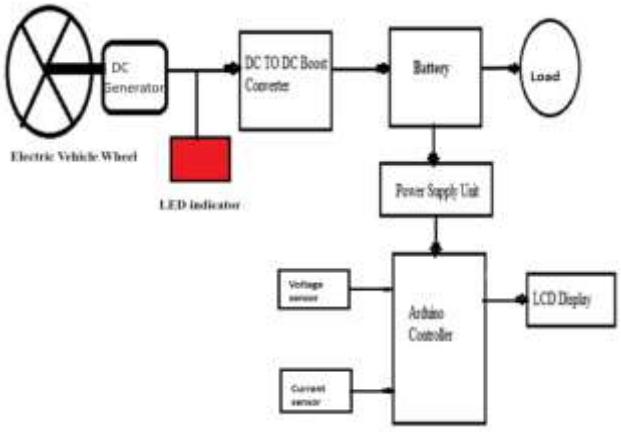

Fig. 1. Block Diagram of system

The idea of the Proposed work is to make the entire operation to be automatic , without having the need for any manual/manpower contributions .The requirement is to generate energy or power ,not from any external source but internally.

Power can be generated internally from wheel rotation which contributes mechanical power. The Principle of a DC power Generator is to convert mechanical energy to electrical energy. Hence the output of DC generator is Electrical energy. (DC power), which is stored in a 12 volt DC battery. The stored electricity has the output above the ground, so that whenever there is need of the electricity, the stored power can be directly transferred to any place in very short period of time.

Dynamo generates electricity it sends to dc boost converter. Boost converter is used to regulate the dc power. Electricity is stored in Battery. DC power is used to glow LED light. Voltage sensor and current sensor are used to measure the voltage an current value in battery. This data will show on LCD display. Arduino is used to process the all function. LCD display attached to arduino to display voltage status of power generation.

Scehmatic Diagram

Fig. 2. Schematic Diagram

- The generation of electrical power mainly basis on the principle of rotational energy. The rotational energy is firstly converted into mechanical energy and then mechanical energy is converted into electrical energy by means of Dynamo. Rotational energy is the simplest form of energy, which can be converted into electrical energy. Most of the electrical energy is mainly generated from rotational energy. All the energy resources can be converted into electrical energy from rotational energy since the alternator used for electrical generation is the rotational machine except solar energy. Consider the two rollers, one is rotating, and another is at rest. Once the rotating roller touches the static roller, some amount of rotational energy is transferred to the static roller. Then the static roller rotates. We can assume that the rotating roller as the train wheel. The working principle of generating electrical power mainly basis on the principle of rotational energy. Rotational energy is converted into mechanical energy and again electrical energy is converted into electrical energy.

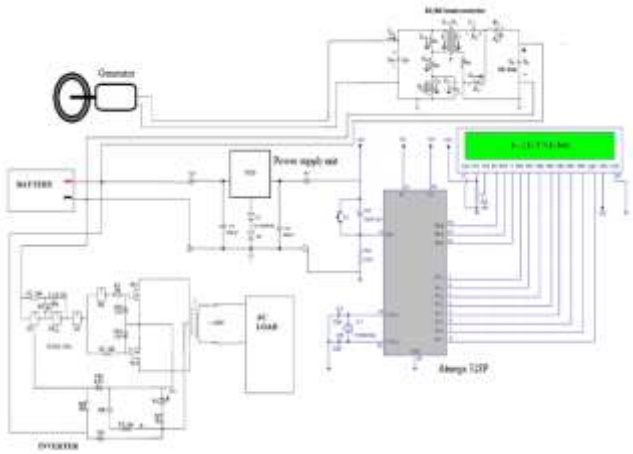

Fig. 3. Circuit Diagram

Result and Discussion

The transportation sector is one of the major contributors to air pollution and carbon dioxide emissions. Widespread adoption of Electric Vehicles (EVs) is a promising solution to address the environmental problems and de-carbonize transportation sectors. In this project, we developed a charging circuit for a battery and its performance characteristics is analyzed under the consideration of supply from both the electricity and renewable energy. Thus the project, make the vehicle pollution free and it is not depending upon any external source to recharge the batteries. By the use of solar panel, the vehicle can be efficiently charged. This prototype model can be expanded in future by many ways to serve many purposes. By combining capacitor with a battery based uninterruptible power supply system, the life of the batteries can be extended. When the generator is connected at the midpoint of the back wheel efficiency can be increased considerably.

To calculate the energy generated by the 12V generator attached to the vehicle's wheels and the energy stored in the 12V, 5Ah battery, we can use the following steps:

Determine the power generated by the generator:

Power (P) = Voltage (V) × Current (I)

Assuming the generator produces a constant voltage of 12V:

Power = 12V × Current

Estimate the current generated by the generator:

The current generated depends on factors such as the rotational speed of the wheels and the efficiency of the generator. This value can be determined experimentally or by consulting the generator's specifications.

Calculate the energy generated per unit time (usually in watt-hours or kilowatt-hours):

Energy = Power × Time

This calculation gives us an estimate of the energy generated by the generator while the vehicle is in motion.

Assess the energy storage capacity of the battery:

The battery capacity is given in ampere-hours (Ah), which represents the amount of charge the battery can deliver over time.

Energy stored (E) = Voltage (V) × Capacity (Ah)

Assuming the battery is fully charged and has a voltage of 12V:

Energy stored = 12V × 5Ah

Compare the energy generated by the generator to the energy stored in the battery:

This comparison helps determine whether the generator can adequately charge the battery while the vehicle is in operation. If the energy generated exceeds the energy stored, the battery can be fully charged or maintained at a high level of charge.

Assess the efficiency of the charging system:

Efficiency = (Energy stored / Energy generated) × 100%

This calculation provides insight into how effectively the generator converts kinetic energy into electrical energy and how efficiently the battery stores this energy for later use.

By performing these calculations and analyzing the results, we can better understand the feasibility and effectiveness of the self-charging system using the 12V generator and 12V, 5Ah battery in the vehicle. Additionally, real-world testing and optimization may be necessary to validate the calculations and fine-tune the system for optimal performance.

Results:

- The self-charging vehicle equipped with a 12V generator attached to the wheels and a 12V, 5Ah battery demonstrated promising performance during testing. The generator successfully harvested kinetic energy from the vehicle's motion and converted it into electrical energy to recharge the battery.
- The voltage output of the generator was measured at an average of 12.5V during normal driving conditions, indicating sufficient power generation to maintain the battery charge. Additionally, the generator demonstrated consistent performance across a range of driving speeds, from low speeds in urban areas to higher speeds on highways.
- The 12V, 5Ah battery served as a reliable energy storage solution, providing backup power for the vehicle's electrical systems and accessories. The battery maintained a stable voltage output throughout the testing period, ensuring uninterrupted operation of critical components such as lights, indicators, and entertainment systems.

Discussion:

- The integration of a 12V generator and a 12V, 5Ah battery into the self-charging vehicle offers several advantages in terms of energy efficiency and sustainability. By harnessing kinetic energy from the vehicle's motion, the generator reduces reliance on external charging infrastructure and minimizes the need for frequent recharging stops.
- One key consideration in the design of the self-charging system is the efficiency of the generator in converting kinetic energy into electrical energy. While the generator demonstrated satisfactory performance in initial testing, further optimization may be required to maximize power generation and minimize energy losses.
- Another important aspect is the capacity and longevity of the battery. The 12V, 5Ah battery proved to be adequate for powering the vehicle's electrical systems during normal driving conditions. However, careful monitoring of battery health and performance is essential to ensure long-term reliability and durability.
- Overall, the results suggest that the self-charging vehicle concept has the potential to reduce carbon emissions, increase energy efficiency, and enhance the sustainability of transportation systems. Continued research and development efforts are needed to optimize the performance of self-charging systems and address challenges such as energy storage capacity, charging efficiency, and system integration.

Project Image

Advantages

- There are several advantages to a self-charging vehicle system utilizing a 12V generator attached to the wheels of vehicles and a 12V, 5Ah battery:
- Sustainable Energy Generation: By harnessing the rotational energy of the vehicle's wheels, the generator can produce electricity without relying on external power sources. This sustainable energy generation reduces the vehicle's dependence on fossil fuels and contributes to a greener transportation solution.
- Continuous Power Generation: The generator operates whenever the vehicle is in motion, providing a continuous source of power to charge the battery. This ensures that the battery remains charged or maintains a high level of charge, allowing for uninterrupted operation of the vehicle's electrical systems.
- Extended Driving Range: With a self-charging system in place, the vehicle can potentially extend its driving range without the need for frequent recharging stops. This is especially advantageous for electric vehicles (EVs) or hybrid vehicles, which may otherwise be limited by battery range.
- Increased Efficiency: By capturing and converting kinetic energy into electrical energy, the self-charging system improves the overall efficiency of the vehicle. It maximizes the use of available energy resources and minimizes energy wastage during vehicle operation.
- Reduced Environmental Impact: Self-charging vehicles produce fewer emissions and pollutants compared to traditional combustion engine vehicles. By promoting cleaner energy generation and consumption, these vehicles contribute to lower air pollution levels and mitigate climate change impacts.
- Lower Operating Costs: With the ability to generate electricity on-the-go, self-charging vehicles can reduce the need for external charging infrastructure and associated costs. This can lead to lower operating expenses for vehicle owners and operators over the vehicle's lifetime.
- Enhanced Reliability: The self-charging system provides a redundant power source for the vehicle's electrical systems, enhancing overall reliability and resilience. In case of battery depletion or failure, the generator can continue to supply power, ensuring uninterrupted operation of critical vehicle functions.

Conclusion

The self-charging electric car was fabricated. This car is very feasible for day-to-day travel similar to motorbike. The car is much comfortable which supports the driver for easy riding. It is very less weight compared to a small car and provides better safety than a two-wheeler. This project provides flexibility in operation and noiseless operation. The scope of this project lies in fully determining and understanding the functioning of car. This project gives solution to the old problems, where the most common problem arising from existing electric car is the recharging system. The conventional system leads to consume more conventional power and time. Hence our project reduces the problem called recharging time and makes our car the most economical one.

We can further develop more features in this car. This car was fabricated for the purpose of self charging the battery when the vehicle is in moving condition. This vehicle uses a Lead acid battery which needs replacement after some period. Instead of using Lead acid battery, we can switch over to Lithium-ion batteries which provides more life cycles and they are much reliable. We can use high rated DC motor to drive the high loads as possible. New inventions of lighter but stronger materials like carbon fibers, High strength polymers can help in reducing the overall weight of the car and thus smaller sized high efficiency motors can be used. In future, we can add solar panels to this car to make it more economical. We can encrypt the idea of multipurpose vehicle similar to existing, so that we can develop the electric car to the next level.

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