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Solar Powered Self-Charging Circuit for Mobile Applications

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Abstract: *Electric vehicles were invented as an alternative to save fuel and to make more environment-friendly vehicles. With the increase in pricing for fuels, all are looking at effective alternatives for fuelled vehicles. Although electric vehicles [EV] are alternatives for our daily means of travel, they have not been very effective with the distance we can travel by fully charging them. The problem with EV is that once fully charged they may run for about 60 km. But considering our society, most of us travel more than 60 km every day. An alternate EV will make a better future. In this project we have aimed at making EVs more efficient and effective for normal usage. We have implemented a prototype of a new circuit with two batteries where each battery works alternatively. Apart from this, we have used solar panels to charge these batteries with solar energy.*

Keywords: Electric Vehicle, Solar Energy, Dual Battery System, Charging Unit

I. INTRODUCTION

Electric vehicles were invented as an alternative to save fuel and make more environmentally friendly vehicles. With the increase in pricing for fuels, all are looking at effective alternatives for fueled vehicles. Though electric vehicles [EV] are alternatives for our daily means of travel, they have not been very effective with the distance we can travel, by fully charging them. The main problem with EVs is that once fully charged, they may run for 60 km. But considering our society, most of us travel more than 60 km every day. An alternate EV will make a better future. In this project we have aimed at making EV more efficient and effective for normal usage.

We have implemented a prototype of a new circuit with a dual battery system and solar panel to make the system more effective and efficient. In the implemented circuit, the first battery is charged as usual, which on completion of charging could be used to run the vehicle. The second battery is connected to the DC motors which will be charged with the mechanical movement of the motors. When the first battery is out of charge, the vehicle could use the secondary battery that is charged due to mechanical movement. We have implemented the "Ward Leonard Driving System" technique and solar energy.

As an additional feature, we have integrated solar panels which acts as source of secondary power charging the battery. The secondary battery is not always dependent on the motionof motors, but it charges on its own with the available solar energy, with this, we can add other features such as mobile charging.

II. LITERATURE SURVEY

[1] Authors of this thesis have discussed how CO_2 emissions can be reduced by battery-powered vehicles. Further approximation is given that 50% of combustion is reduced compared to internal combustion vehicles. They have also discussed petrol emissions by Ford Focus.

[2] Update on Canada's progress in electrification of personal transportation. Since 2013, the number of Canadian citizens who consider EVs a viable option has increased by 50%. It is clear that greater outreach and awareness is needed: 92% of citizens believe there are limited public charging stations and 14% were unaware that the vehicles can be charged by connecting them to household plugs.

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[3] Depending on the type of the electric vehicle, various technological areas are being worked upon. One of the technological areas in the electric vehicles is the development of newer control architectures.
[4] The EV scenarios assessment shows that direct financial incentives to EV buyers and support to upfront investments in infrastructure can help increase the share of EVs in India in the short to medium term (2030). In the long run however, EVs can be competitive vis-à-vis conventional vehicles under a low margin.

III. Problem Statement

Conventional vehicles use forms of fossil fuels and process of combustion for the vehicle movement. Combustion as known as, a process that emits harmful gases like CO, hydrocarbons etc., these gases are threats to all lives on earth.
Other types of fuels such as biogas, natural gas and other types of oils are also used instead of existing fossil fuels. The fossil fuels can exist only for a certain period of time and it also becomes costlier and creates environmental issues.
Other sources of energy such as Hydro, Solar and Wind energy are also prevalent. Electric Vehicles were invented as a solution to fuelled vehicles. But these vehicles use batteries, which once charged can run for limited distance only, which makes these vehicles not very efficient. If we add a self-recharging circuit arrangement in the electric vehicle, then the charging time can be reduced.

IV. Existing Vs. Proposed System

Fuel is majorly used in vehicles these days, but Electric Vehicles have come to use which, as discussed above, have issues with their charging methods. These vehicles once fully charged, can run for around 60kms or minutes. This cannot be convenient for daily use. This problem was overcome with a recently proposed system with self-charging batteries. But the method of charging is not effective as it uses only the mechanical movement of the motors to charge the secondary battery. We have proposed a prototype that uses solar energy as a secondary source to charge the secondary battery.

V. Methodology

The motor gets its power supply from the battery, motor starts running and generator is coupled to motor. The energy generated passes through the DC to DC Buck, letting us know the amount of energy generated. On the other hand, we have the solar panel connected to the charging module. This panel converts solar light into usable form of energy, which is the alternative form of energy we have implemented in this prototype. All the energy generated by the device is transferred to the charging module, this module collects energy acting as a diode charging the battery. As for the prototype, we have used smaller batteries that can be used to charge power banks or mobile phones. Once the battery is fully charged we can charge our device with it. Also, we have integrated an LDR module which is used to prototype the headlights of the EV.

5.1 Hardware Components

1. **DC 5 Volt BO Motor:** The BO Series1 60RPM DC Motor Plastic Gear Motor – BO motor has better torque and low operating voltages of rpm. The shaft when matches wheels, gives an added advantage to any robot or motor being designed. Its lightweight body and mounting holes make it easier to use. The motor we used could be connected to a 69mm diameter shaft. We use these motors by connecting them to wheels of the vehicle such that when the wheels turn around, motor rotates and it could help the battery to charge.
2. **Charging Unit:** The TP4056 1A Li ion Lithium Battery Charging Module – Micro B USB is a 3.7V lithium battery charger module has on-board Micro USB interface. Micro USB interface in this module helps us to use it as a temporary source of charging the battery. This module is connected to the Buck motor to help transfer the charge from motors to battery.
3. **Volts Battery:** Standard 14500 850mAh 3.7 Volt Rechargeable Li-ion battery, this is a major component of our prototype. We use this rechargeable battery as second battery that gets charged on the motor running and solar energy. Li ion batteries are easy to implement in small projects. They are mostly major sources of power

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in many devices. We all know that they have completely replaced non-rechargeable batteries due to their durability. This makes sure that the prototype is durable and effective.

Figure 5.1: 5V DC 150 RPM Single Shaft BO Motor

4. **Solar Panel:** It is a 20W, 12V panel which has better performance under less sunlight too. We have used this to add a special feature to our prototype i.e., using solar energy as an alternative source of power.

Figure 5.2: 20W 12V DC Mono-crystalline Solar Panel

5. **LDR Module:** We use LDR to measure the intensity of energy. LDR module is connected to battery, the light connected to LDR glows brighter when the secondary battery is fully charged and lighter when charge of the battery is low. Signal detection could be managed with potentiometer.

Figure 5.3: LDR Module

5.2 Circuit Connections

In the improved circuit for self-charging, the connection is made as shown in Fig.5.4. Initially two DC motors are connected to the wheels, each of one DC motor is connected to DC female pin and DC to DC Buck module. The DC to DC buck module is connected to charging module, the charging module in turn is connected to the solar panel for the solar charging purpose. Charging module is connected to the battery and power bank for charging the battery. LDR module is installed to indicate the charging completion process.

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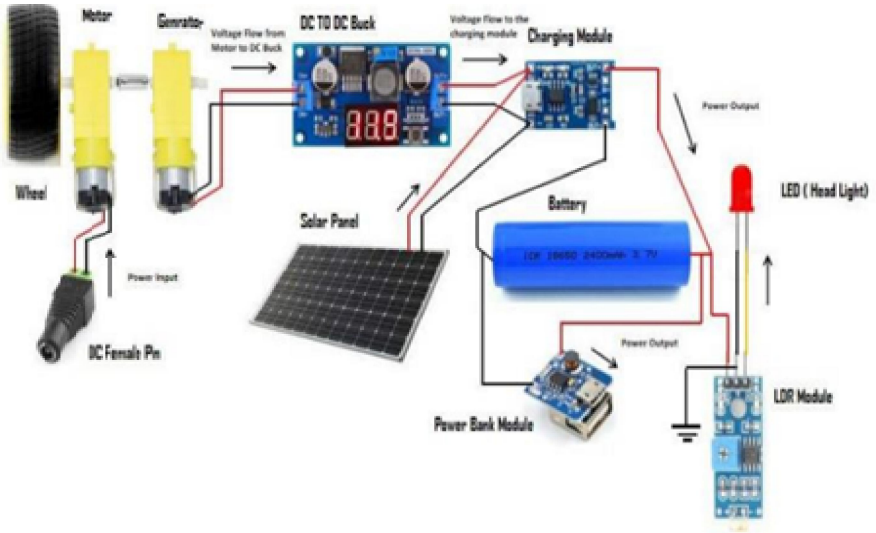

Figure 5.4: Circuit Connection of Charging Module

VI. RESULT

The prototype is successfully implemented, with self-charging batteries. First the battery is charged; this charge is used to run the motors. The motors' mechanical energy when running is used to charge the second battery. Apart from mechanical energy being converted to electric energy, the solar panel uses solar energy to charge the secondary battery. All features are working as expected.

This prototype takes lesser time to recharge the batteries and by doing so, energy can be conserved easily. The typical energy dissipation process can be avoided as the motor-generator system reuses the energy. As discussed in the previous section, a power bank can be added to the circuit to store more amount of energy as reserve. This reserve can be used for applications that require more input power and where power losses are inevitable.

VII. CONCLUSION

Considering the types of pollution caused these days, air pollution has been a major part of it. The major cause of air pollution is CO_2 which is emitted by mostly fuelled vehicles. Widespread adoption of Electric Vehicles (EVs) has been a better method for pollution-less transportation. Here in the project, we have shown a prototype of the project as the actual project would be bigger and more in cost, but when we implement this idea over real time vehicles, we can use the same power we generated through the generator in the vehicle then it would be a proper self-recharging bike. We have also used automatic headlight system for the bike, as to save power of the headlight getting ON unnecessarily. This prototype model can be used in Aviation, Vehicles, Street lights etc. This prototype model will also help reduce the use of ICE vehicles and user friendly. This model can be expanded in the future by many ways to serve many purposes.

The current battery charging technology is constantly growing and with each progress that we make, the cost of charging increases per kWh. Although new techniques such as the Memory Effect, where the prototype relies on the effects of the previous charge-discharge cycle, is currently trending in battery technology, the complexity and size of the charging unit increases. This leads to increase in production cost and operation and maintenance costs as well. In such cases, prototypes like the above mentioned, are potential saviors as they cause lesser complications and reduce environmental effects as well. Furthermore, such a circuit can be used for a wide range of sizes and shapes, and with the right brains, can be integrated into ICs as well.

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