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Enhancing the E-Vehicle Battery Power by Widdey Circuit

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Abstract

The charging time required for accurate and environmentally friendly propagation has been the most pressing concern with purchasing electric vehicles. The main motive of our paper is to reduce the charging time (like to convey: Eliminates the charging time), it can be achieved by using our Project "WIDDEY" circuit, which acts as a power source for the vehicle to work. The charging required for WIDDEY is the ratio of 1:5000. A democratic country has the responsibility to develop their citizen's comfort as their main concern and confirm that all the area is in a habitable environment, for these the fossil fuel vehicles play a crucial role in depleting the environment. Both developing and developed nations should ensure the citizens' health from avoidable pollution, for these E-Vehicles have the best ways to reduce the noise, air, and carbon pollution in the environment. A question may arise "Is that E-Vehicle a zero-polluted vehicle that doesn't emit any pollution?", it concluded with an answer NO. E-vehicles also produce some kind of pollution at the rate of 0.002%, significantly less than the pollution emitted by fossil fuel-related vehicles.

Keywords: *Word- E-Vehicle, Widdy circuit, Inverter, DC-DC Booster Module*

1. Introduction

The E-Vehicle is a promising technology that tends to lead the automobile industry into the next extent of automation which drives the transportation sector with the next-gen of development. E-Vehicle can easily compensate with advanced fossil fuel-based automobiles (i.e.; the Tesla Model S car is easily compensated with the Lamborghini Huracan). The main motive of the E-Vehicle based on the government references is to reduce carbon emission and global warming. The pollution which is emitted by the E-Vehicle is nearly 0.002%. From the recent survey, the discernment of lithium-ion reserves of around 3.5 tonnes in Jammu & Kashmir tends to boost the E-Vehicles industry in India. [1] The increasing usage of fossil fuel compared to the past year is relatively huge in the present days, these overall usage increases the energy crisis in all developing this may lead to an option for the consumer to swap from fossil fuel-dependent vehicles to electricity-based vehicles. The DC motor is used as a propagating machine to move the vehicle for a required displacement. [2] The development of the EV sector is increasing day by day due to this development constant innovation is the furthest point to keep the EVs on the people's minds. As usual, batteries are used as a storage reservoir for the power to the vehicle. The batteries are usually charged by a charger which converts the AC to rated DC to charge the batteries to work. A dynamometer is used to boost the battery's power while the vehicle is in running condition. These types of dynamometers will increase the efficiency of the vehicle significantly. [3] Traditionally motor is used as an engine for the vehicle to propagate where it's an AC or DC. Semi-automatic vehicles are used as a low-cost effective vehicle to accomplish the work done by the petrol-related bike. Semiautomatic in the senses, the main motor

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gets power or tends to work when the driver turns ON its respective switches otherwise the vehicle can be run by the mechanical work given to the pedal by the driver a shaft is connected to the pedal that end is connected with the generator which is used to cooks up the charge to the battery. When the driver turns ON the motor tends to run and the pedaling mechanism is not required by the vehicle to propagate [4]. Due to the decrement of fuel in the fossil fuel reservoir, the automobile sector had pushed to the concern of swapping to another fuel-based vehicle, at this point EVs have concluded the above-mentioned quality to halt the automobile sector from a significant downfall. The government has a particular scheme to develop EVs all over the country which may lead to the growth of many entrepreneurs in the EV fields to fulfill the upcoming demands that arise in the automobile sector.[5] Mostly EVs use DC motors as their propagating device to undertake the process of propagation. BLDC motor is one of the motors used as an engine in the EVs to propagate. BLDC motor has more durability, high efficiency, and less weight and dimensions compared to other species of motor.[6] The fully electric-based vehicles are used current domination of EVs for an alternate selection rather than the fossil fuel-based vehicles, for charging these EVs power adopted is employed in-house and in other public places to charge the vehicle power sources.[7] The two ways power-driving EVs are commercial nowadays due to their high efficiency and low cost-effective manner compared to the fuel-based vehicles which are used traditionally, in both the solar and batteries act as a power source for the vehicle.[8] As per the recent survey based on the next revolution, the automobile sector is bringing EVs as their priority mode of manufacturing in the field of automobile sector to accomplish the upcoming demands of the automobile sector. As compared to the fossil fuel cost for propagation is less compared to the EV propagation cost. [9] During COVID the population of EVs on the Indian market is comparatively higher than in the past ten years it increased in the number of 10% registrations held after the lockdown. Due to these EV production and sales are increased by 10-30% in 2030.[10] Lithium-ion batteries are used as a power reservoir for the EVs to increase the efficiency of the batteries AAA sized lithium batteries are used to supply power to the vehicle, the batteries are arranged in series to maximum voltage with a minimum number of batteries and get better cooling capacity and heat resistive capacity to safeguard the battery from overheating.[11] Usually, batteries are sensitive to the surrounding environment, the batteries get drained quickly when it's in a cold condition and the batteries get heated up while supplying charge when it's in a hot condition, these can be controlled and the efficiency can be increased by using BMS circuit embedded with the battery output.[12] The battery management circuit (BMS) is attached to the battery to increase efficiency, these BMS circuits regularly monitor the battery's output when a quick charge takes place the circuit opens and regulates the output then supplies power to the system.[13] The automobile sector to swap for the next generation vehicle is EVs which has numerous advantages and profits for both the environment and consumers, a recent survey on many developed countries' EV development and infrastructure has separate fund allotments for their Electric vehicles in their countries for the reason of reducing carbon emission and global warming in their countries.[14] As per a recent survey, foreign countries use E-Vehicles as their major sources of transportation. They have well-developed public transportation that uses electricity as their fuel for public transportation such as electric trains, E-Bus, Electric yachts, and so on.[15] Carbon emission, Air pollution, and global warming are the paramount reasons for the earth's depletion the resources. Fossil fuel-related vehicles emit carbon deployment on the surroundings while the vehicle is in running condition. Compared with EVs to fossil-related vehicles, fossil fuel vehicles are the major reason to pollute the environment in the ratio of 60-70%.

2. Equipment and its description

2.1 Lithium-Ion Battery

The Lithium-Ion batteries which use their free

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electron from the Anode pass through the negative electrodes and close the circuit then the end of discharge the remaining ions return to the positive electrode. The whole reaction which is carried down by the batteries is called a redox reaction. When the process of charging the lithium-ion moves front and back between the two electrodes. As per the design, we use 12V(7200mAh) batteries for their power, which have 14.4V as their peak voltage and 9.8V as their drop voltage

2.2 Inverter

The inverter is an electronic component that is fairly used to convert the DC into AC. In these 12V Direct current is converted into 220V Alternating current, which uses IC as their control unit for the above-mentioned conversion. In this process, the frequency of the current varies apparently. In our design, we use a 12v-220V (150W) inverter is used to convert the DC into AC shown in Figure 1.

Figure 1 DC to AC Inverter

2.3 Rectifier

The opposite process to the inverter that is carried out by a device is called a rectifier. It's an electrical device that converts the Alternating current (AC) into Direct current (DC) with a constant frequency. From our design, we use 220V(AC)-12V(DC) for charging the lithium-ion battery that is used in our circuit to produce power.

2.4 DC-DC Booster Module

The DC-DC Booster Module is the electrical component that is used to boost up the DCs that are fed up in the input to output as shown in Figure 2. The DC booster module has screw adjusted relay to adjust the current and voltage that are coming up to the output. By adjusting those mechanical screws in the relay, the output voltage and current are varied based on the adjustment of the screw. In our design, we use the 12-83V_20A_1200W module to boost up the current for the vehicle. A quiz may arise "Why should use DC-DC Booster Module?". It concludes with the basic answer that, the main reason to use the DC booster module is to reduce the overall cost of the production of EVs. It is a technical way to acquire the required voltage by using it, otherwise to acquire the required voltage high power batteries are used. The battery power is proportional to their cost.

Figure 2 DC-DC booster module

2.5 Battery Level Indicator

Battery level indicators are those electric components that are widely used to indicate the power that is available in the battery. The battery level indicator uses LED light to represent the charge that is available in the battery. A series of horizontal blue lines are employed in the indicator to help the viewer recognize the total power remaining in the battery. In our design, we use a 12V Lithium-ion DC indicator to indicate the charge available in the battery as shown in Figure 3.

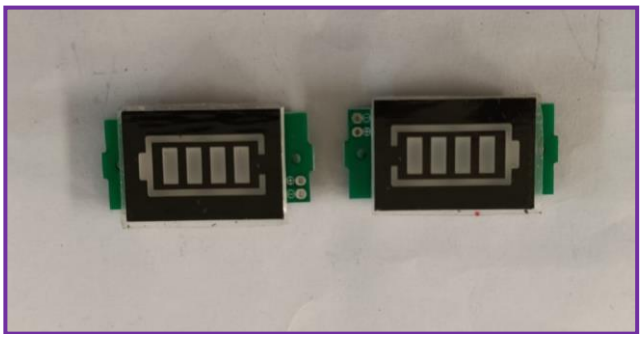

Figure 3 Battery Level Indicator

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3. Working Principle

In our WIDDEY circuit two lithium-ion batteries are used one battery is fully charged (100%) and another battery is partially charged (30-40%) without attaining the drop voltage of the battery. The battery which has an output line and charging line separately in this charging line is embedded with the female auxiliary port and the output line is just a wire-ended joint. The output of the battery is connected with the inverter which has a rating of 12V-220V 150W. The inverter converts the direct current from the battery into an alternating current with a varying frequency. This process proceeds because it increases the voltage and varies their frequency and the furthermost reason is that increases the Watts. The inverter gives 300V as its no-load voltage and gives 210-240V as its load voltage. The output of the inverter is split up into two lines. The Widdy circuit is shown in Figure 4.

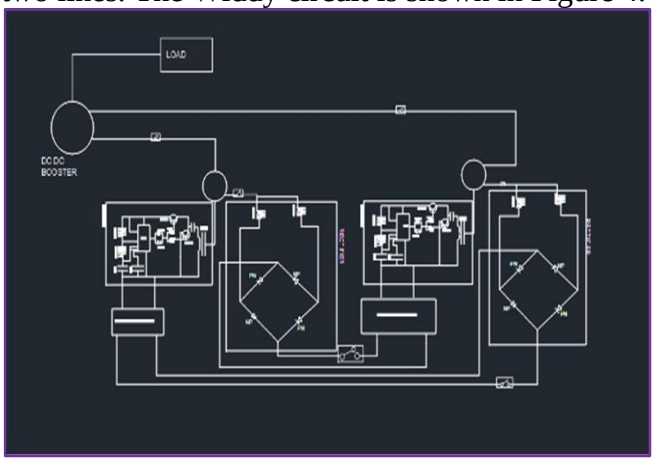

Figure 4 **Widdy circuit**

One of those lines is connected to the rectifier which is used to charge the partially charged battery and another line is connected to the main rectifier which is used as an input for the DC-DC Booster module and tends to boost the voltage and current based on the preference that we need. In this WIDDEY circuit, two pairs of six switches are used. The three switches are used in the first fully charged lithium-ion connection. Let us explain the function of the first three switches, switch A is connected to the inverter which is connected to the output which tends to supply power to the rectifier which is used to charge the partially charged battery. The switch B is connected with that which acts as a gate on the connection partially charged battery's female port. Hardwire connections of the Widdey circuit are shown in Figure 5. The swapping of the Switch for power transmission is shown in Figure 6.

Figure 5 **Hardwire connections of Widdey circuit**

The Switch C is connected with the main DC-DC Booster module. Another pair of remaining switch connections are connected according to the above-mentioned method. The switch will swap to attain the endless power supply to the vehicle. In those swap mechanisms, a pair of three switches are turned ON, the three switches are relatively connected with that fully charged battery and vice versa to the next partially charged battery.

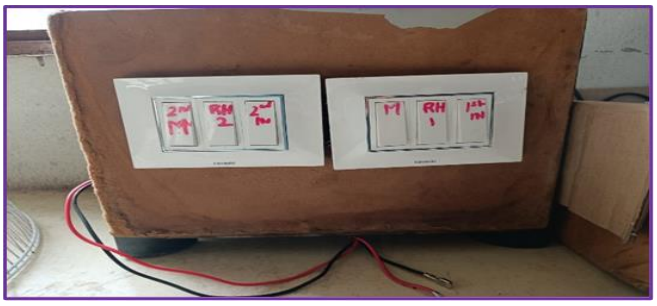

Figure 6 **Swapping of Switch for power transmit**

When battery 1 gets drained battery 2 will be charged then the swap mechanism of the switch has to begin. The battery 1 is in drop voltage the pair of first three switches is turned OFF and the next pair of switches is turned ON which tends to close the circuit to the battery 2 and leads to supply power to the vehicle.

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4. Design Calculation

4.1 Inverter

$$\text{Power(P)} = \text{Voltage(V)} * \text{Current (C)}$$
$$= 220 * 12.5$$
$$\mathbf{Power(P) = 2750VA}$$
$$\text{Resistance(R)} = \frac{\text{Power(P)}}{\text{Current2(I2)}} = \frac{2750}{156.25}$$
$$\mathbf{Runtime(t) = 1hrs8mins}$$

4.2 Rectifier

$$\mathbf{Resistance(R) = 17.6\ ohm}$$
$$\text{Vdc} = 0.637 * \text{Vrms} = 0.637 * 17$$
$$\mathbf{Vdc = 10.829V}$$

4.3 DC-DC Booster Module

$$\text{Duty cycle(D)} = \frac{\text{Output power}}{\text{Input power}} = \frac{24}{12}$$
$$\mathbf{Duty\ cycle(D) = 0.5}$$
$$\text{Output voltage(Vo)} = \frac{\text{Input voltage}}{1 - \text{D}}$$
$$= \frac{12}{1 - 0.5}$$
$$\mathbf{Output\ Voltage(Vo) = 24V}$$

4.4 DC Battery

$$Backup\ Time(hrs)$$
$$= \frac{\text{Battery Capacity(Ah)} * \text{Input Voltage(v)}}{\text{Load}}$$
$$= 6 * \frac{12}{100}$$
$$\mathbf{Backup\ Time(hrs) = 1hr\ 12mins}$$

4.5 Motor

$$\text{Load(RPM)} = \frac{\text{Frequency(Hz)}*60*2}{\text{No of poles}} = \frac{50*60*2}{4}$$
$$\mathbf{Load(RPM) = 1500\ RPM}$$
$$\text{Power(P)}$$
$$= \frac{2 * 3.14 * \text{Speed(N)} * \text{Torque(T)}}{60}$$
$$= \frac{2 * 3.14 * 1500 * 9}{60}$$
$$\mathbf{Power(P)}$$
$$= \mathbf{1413W}$$

5. Result

As per the idea of our design, the WIDDEY circuit delivered the required amount of power to the vehicle. As the rating mentioned in the controller of 24V, we designed the output as 28V but the WIDDEY tends to supply the voltage of 85V as their peak voltage. The voltage adjustment can be achieved by adjusting the screws in the DC-DC Booster module. In that, both current and voltage can be adjusted (2-20A/6-84V). By using these the vehicle can propagate a weight of max.250kgs for a required displacement.

Conclusion

By using the WIDDEY circuit the carbon emission on the environment had reduced significantly. The carbon emission on these types of EVs may be from 0.002-0.005%. The other considerable advantage of using is it's a low noise-making propagating device compared to petrol-based vehicles. By using EVs noise, air, and carbon pollution are reduced. The lithium deposits in India will lead the Indian EV market on top of the other developing countries [16]. If petroleum-based vehicles tend to stop running the EVs which leads the automobile sector to the following decades, it's the only path to avoid the energy crisis and global warming. The development of EVs significantly reduces the carbon deposit in the environment and makes the environment safe and much more habitable to all living beings compared to nowadays environment. The reservoir of lithium-ion deposits in India will make EVs much more affordable to kind of people. [17-19].

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