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Design of Electric Vehicle

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Abstract: This paper shows about the ongoing advancement and future techniques in Electrical Vehicle (EV) additionally gives an outline of the various components and parts of EV. Because of the expanding development in urbanization and web network (Internet Connectivity) the way of living life has been changing step by step. So as to improve the diminish emissions in the environment air and to enhance fuel efficacy of the vehicle the utilization of ordinary vehicles must be decreased and the execution of EV ought to be promoted. The primary point of this paper is to clarify the significance of EV for reduction in greenhouse gases produced from transportation which is major environment issue and it is expanding step by step. By utilization of EV this issue can be resolved. That is the reason for design of EV is done in such manner that it is light in weight, effective, and can be control easily.

Keywords: Battery, EV, Hub Motor, Motor Controller.

INTRODUCTION

These days it has been seen that the "non-renewable energy" sources have been turning out to be wiped out step by step. Because of this the expense of fuel for running the vehicles has been expanding enormously[1], [2]. So as to conquer the expanding the expense of fuel the utilization of electric vehicle has been considered, since conventional vehicle run because of ignition of "non-renewable energy" which prompts global warming. It additionally radiates harmful gases like, CO_2 and CO, so forth which prompts ozone layer depletion and global warming, likewise "non-renewable energy" sources are restricted and they need a very long time to produce. The primary point is that we can't refill them according human needs[3]. The environment takes its necessary time to fill those sources. So considering the utilizations and requirements of energy from fuel, we have to move to other energy sources and here comes the "renewable energy" sources in account[4].

A vehicle which is driven by renewable energy is light weight, more efficient, pollution free, and does not harm nature in any sense[5]. Also renewable energy driven vehicle doesn't consist of oils, pistons, which makes the vehicle light weight and thus easy to handle. Control of this EV is easy and anyone can easily ride & reach to their destination. Many automobile industries are moving towards the renewable source to power their vehicle. People have to serve a better future to their next generation so that's why they just go green.

METHODOLOGY

1. Electric vehicle (EV):

EV is mainly classified in two following types:

a) All Electric Vehicle (AEV)
b) Plug-in Hybrid Electric Vehicle (PHEV)

AEV is further classified in two types:

- Battery type EV
- Fuel cell type EV

The electric energy is stored in the battery and it is given to the electric motor by which the electric motor

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is run. Since electric vehicle doesn't have any ignition engine, there is no way of emission of fumes gases in the environment. For providing driving force to the vehicle, the battery should be adequately charged, the electrical energy for charging the vehicle is acquired from the "renewable energy" sources like solar, wind, hydro-electric, and so on. The most well-known and productive "renewable energy" sources utilized for charging the battery is by utilizing solar energy[6], [7].

The favorable point of utilizing solar energy is that we can execute the solar panels on the body of the vehicle. The panels can be utilized by our needs. The panels can be fixed on the rooftop, front and back side of the vehicle. At the point when the pedal of EV is press, the controller picks up energy from the battery. This electrical energy is conveyed to the motor where it is changed over into mechanical energy. This turns on the motor. This motor along these lines pivots the wheel which thus moves the vehicle.

2. Hub Motor:

BLDC (Brushless DC) motors have been much focused region for some motor production industries as these motors are progressively the favored decision in numerous applications, particularly in the field of motor control techniques, with the improvement of sensor less techniques other than computerized control, these motors become so efficient in consideration of overall system cost, size and unwavering quality[8].

A BLDC motor (known as Brushless DC motors) is a "permanent magnet synchronous electric motor" which is driven by direct current (DC) and it achieves electronically controlled commutation system (commutation is a process of generating torque in motor by changing phase currents at appropriate span of time) rather than a mechanical computational system. A BLDC motor structure is shown in the Fig. 1.

Brushed motors and brushless motors have some mutual characteristics like high rpm, good heat dissipation and high efficiency. It comprises of a rotor of permanent magnet and stator of "polyphase armature winding"[9]. The dissimilarity among regular and BLDC motor is that BLDC motor doesn't contain brushes which doesn't increase its commutation not at all like traditional dc motors. Commutation in BLDC motor is done electrically by utilizing an electrical drive that must be fed to the winding of stator. The benefit of utilizing BLDC hub motor is that they take out the differential losses and helps to simplify the drivetrain. These motors are associated with all four wheel separately. The handling with stability of the vehicle is improved by utilizing this structural unit. The longitudinal power can be controlled separately of each wheel. Alongside these structural benefits like dustproof, waterproof, increment in unsprang mass and efficient cooling. Because of numerous advances in BLDC hub motor, the analysts attempt to increase its rate of performance. According on research on the weight and torque of the current conventional vehicle, BLDC motor drive and its controller design can be made.

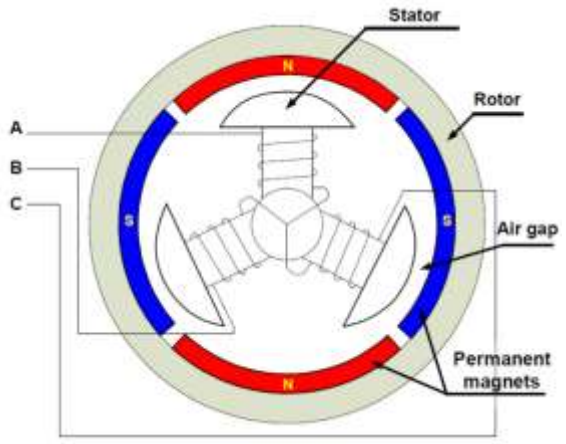

Figure 1: Structure of the BLDC

In this way the expense of the vehicle is decreased because of the advances made by the BLDC motor. BLDC motors are exceptionally durable, simple design and gives output in high rpm. Motor controller controls this motor. Rotor positions are required for the motor controller to control the motor. This rotor position can be discovered by the motor controller by utilizing the rotary encoder or hall effect sensor. Some different techniques include estimating of the back emf in the undriven coils of the BLDC to detect the rotor position. Logic circuits control the output terminals. The speed and acceleration are overseen by hybrid controllers utilizing microcontroller.

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A "lead acid battery" is utilized to stimulate the BLDC motor. The genuine speed of the motor is given by the hall sensors mounted by the BLDC motor. The reference signal is taken as the sign from the accelerator which comprises of the output of varistor which is to be sustained to the controller.

These two sign are equating in the controller and the power output is transformed from the chopper. This signal output from chopper is sent back to motor. In this manner studying the performance of the power output from the chopper. The speed of the motor can be constrained by the motor controller.

3. Motor Controller:

Motor controller controls the different properties of the motor to acquire enough current and applied voltage to motor. Electric motor contains commutator and brushes for its Commutation. In a large portion of the electric vehicles BLDC motor is utilized which is much better than brushed DC motor, permanent magnet DC motor, switched reluctance motor and AC induction motor in numerous viewpoints. In any case, since BLDC motor doesn't have brushes and commutator, the electric vehicle which would utilize BLDC motor needs to utilize motor controller which would increase its commutation. Power is taken from the batteries and provided to the motor controller. The accelerating pedal is connected to variable resistors which offers sign to the motor controller to change the speed of the vehicle according to needs.

The controller conveys zero power when the vehicle is at static position. At the point when the driver presses the pedal, the controller conveys full power by which the vehicle is accelerated. As the driver presses the pedal the speed of the vehicle can be changed according to the acceleration. This is finished with the assistance of the motor controller. Motor controller takes Power from the variable resistor by "single variable resistor".

In any case, in the greater part of the electric vehicles, two "variable resistors" are utilized for security reason. In the case that one variable resistor notable to work, the other variable resistor can be brought into work. The signal gave by the variable resistor is conveyed to the motor controller. If there should be an occurrence of two variable resistors, the motor controller peruses both the variable resistors and considers the further activity. On the off chance that the sign gave by both the variable resistors are not same, Then the motor controller doesn't work.

4. Design of Solar Operated Electric Vehicle:

Solar electric vehicle is to give enormous riding delight to the rider who wishes to ride solo. A smooth, light weight and fast to ride vehicle ought to give an extreme ecofriendly and economical cruising experience to driver. The chassis is the foundation of the vehicle. The chassis design ought to be basic. While weight is a predominant concern, it is just one of a few factors that add to a better design of vehicle. In a straight line, the solar vehicle must fit inside a cuboid of 2540mm long, 1524mm wide and 1524mm high, with the base incidental with the ground.

a) Ground Clearance:

The completely loaded solar vehicle must have at least 152.4mm of ground clearance which will be estimated between the ground and the lowermost piece of the vehicle.

b) Weight of EV:

Vehicle weight ought not surpass 180 kg, without the driver.

c) Wheel Size:

The wheel measurement ought to be at least of 304.8mm or maximum of 355.6mm.

- Tread Width:

Maximum 165.1 mm and at least 90 mm.

- Load rating:

Greater than the force (load) on wheels.

- Speed rating:

Greater than the most extreme speed of the vehicle.

d) Chassis Material:

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The pipe of cylinder/rectangular shape utilized in the chassis manufacturing or different supports can be Seamless or seam.

e) Steering System:

Good "steering geometry" is significant for control at any speed. Deciding the length and position of the considerable number of components is presumably best controlled by experimentation, so it is advisable to work in the same number of additional mounting holes. Passable all steering system free play (comprehensive of play in all the guiding linkages) is constrained to 10 degrees, estimated at the controlling wheel.

4.1 Braking System:

The brakes are one of the most significant control parts of vehicle. In braking system, two Disk brakes are utilized on the front hub to be increasingly successful and drum brake on back pivot helping to slow or stop the vehicle in a split second subsequent to applying the brakes. TMC is utilized as master cylinder in vehicle, in light of the fact that the TMC applied brake power into hydraulic driven weight which is moved to the wheel units through two separate circuits[10].

4.1. Disk Brake Selection on Front Tires:

- Warming of the Brake rotor builds its thickness in this way causing no losses in volume of brake fluid.
- Preferable stable over Drum Brake.
- Increment in temperature doesn't influence the Disk pads.
- The design of braking is simple.
- Disk brakes has good "anti-fade properties" over drum brakes.
- The significant advantage of the disk brake is its capacity to work with little fade at high temperatures of up to 1000 to 1100 K, while drum brakes are profoundly temperature touchy.
- Dirt and water resistance. Better cooling, Friction surfaces are legitimately presented to air in disk brake while in drum the rubbing surfaces are not directly presented to air.
- Disk brakes is exceptionally less as contrasted and the traditional drum type brakes, the rough proportion being 1:4.
- This implies in Disk brakes, the weight force must be impressively more prominent than in the drum type.

4.2. Disk Brake:

Disk brakes are genuinely easy to work with, when parts and their capacities are known[11]. The principle parts of a Disk brake are:

a) Rotor
b) Caliper, which contains a cylinder.
c) Brake pads

Contact between the pad and disk slow down the wheel.

a) Rotor:

Brake rotors are metal Disks. It is a significant segment in the braking mechanism. The caliper is clamp on to disk to slow their revolution, and afterward moderate or stop the vehicle. The disks of the brake have been customarily made of pearlitic dim cast iron. It is modest and has great enemy of wear properties, cast steel disks likewise utilized yet downside in their cases are less uniform grating conduct. As of late earthenware production and carbon fiber likewise utilized. There are two sorts of disk brakes:

- Solid sort
- Ventilated sort

b) Caliper:

Calipers are the lodging that contains the cylinders and the brake pads. The Calipers are associated with the Hydraulic system, and hold the brake pad to the Rotor. There are two primary kinds of calipers.

- Floating (or sliding) calipers
- Fixed calipers

c) Brake Pads:

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Brake pad are a key part s of braking system since they are the segment that contacts and applies weight and rubbing to a vehicles brake rotors. Brake pad are intended for high grating.

4.3. Brake Circuit:

In Brake circuit, the two autonomous line from the TMC is activated by single pedal for locking the two wheels on front adequately. And furthermore give another pedal to locking the back wheel with drum brake.

5. Battery:

EV can-be categorized depending on the power source, they are Battery Electric Vehicles(BEV), Hybrid Electric Vehicles(HEV), Plug-in Hybrid electric vehicles(PHEV), Photovoltaic electric vehicles (PEV) and Fuel cell electric vehicles (FCEV). Because of the propelling innovation, the rechargeable batteries are being broadly utilized as the significant energy sources in EVs.

For the improvement of the new age of EVs, the most encouraging competitor among all the current battery advances is the Lithium Ion battery. When contrasted with every single other battery, Lithium Ion batteries are prevalent as far as high energy productivity and force plan, which makes the EV lighter and littler in size. Lithium Ion batteries likewise progresses in expansive temperature scope of activity, quick charge capacity, low self release rate, long life cycle and no memory impacts. Because of these promising highlights, the lithium Ion batteries are now embraced in for business purposes in purchaser gadgets like mobile phones, workstations, PCs, camcorders, advanced cameras, power instruments and numerous other versatile gadgets.

There are various kinds of Lithium Ion batteries which have diverse energy capacity, which helps in deciding the reasonableness and probability in applications. The Lithium Ion batteries can be additionally grouped into four sorts, they are Lthium Cobalt Oxide(LCO), Lithium Manganese Oxide(LMO), Lithium Iron Phosphate(LFP) and Lithium Mixed Nickel-Manganese-Cobalt Oxide(NMC).

CONCLUSION

A design of EV, which includes estimation of the necessary battery limit and motor power, is completed. It shows that a 650W motor will have the option to drive the vehicle while 44V batteries. Along these lines by utilizing such advancements as exhibited in this paper will supportive to car industry towards electric vehicles.

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