

## Review Paper on Electrical Vehicle

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**Abstract**— In market there are many hybrid vehicles are being used since from days, in addition to that electrical vehicles are being introduced in car market. The reason behind using these cars are because of lower amount of greenhouse effect, decreased dependency upon oil and also higher energy efficiency. This paper give the overview of working of electrical vehicle. Problems with electrical systems or batteries are not being encountered. The major components of vehicle such battery, motor, braking system, controller connections are being examined. Over the long term, vehicles would represent sustainable technology path.

**Key words:** Electrical Vehicle

### I. INTRODUCTION

Now a days, there is increasing demand for fossil fuel like petrol and diesel to power automotive and some needs of human beings. Fuels like petrol and diesel are being depleted because of their excessive use and limited stock. Use of fossil fuels are tends towards the pollution. In cities level of pollution from vehicles during peak hour is dangerous. To avoid this problem and to keep our environment free from pollution and human health there is need to explore alternative in place of fuel powered vehicles. Electrical vehicles came into existence in the mid-19<sup>th</sup> century.

An electrical car also called as Electric vehicle. There are two types of electric vehicle technology: Hybrid and pure electric vehicle. An electrical vehicle can be powered through a collector system, or might be self-contained with a battery, solar panels or an electric generator to convert fuel to electricity. The electrical car uses energy stored in its rechargeable batteries by common household electricity. Hybrid car is fueled by gasoline and uses a battery and motor to improve efficiency. An battery electric car is propelled by one or more electric motors, using energy typically stored in rechargeable batteries device .The growth of the electric vehicles is a perspective and important process. The biggest pros of electric vehicles that they do not pollute the environment and emit less harmful to the nature gas. That's why the mass.

However, for charging the vehicle energy does not have to be produced from renewable sources e.g. from solar, wind or hydroelectric. Zero emissions vehicles is also another name of electric vehicle and it is environment friendly than gasoline vehicles. In electric vehicle there is no engine hence no oil changes and there is no exhaust. So maintenance for moving parts also less. They having pros such as quite in operation and energy efficient. An electric car is of rechargeable battery, controller and electric motor, these are main parts of it.

First the battery is powered. The controller converts the current from DC-AC, and this power is used by the motor. The motor converts electrical energy into mechanical energy. There have been reports of lithium ion batteries catching fire and exploding, but extra safety measures are installed to

ensure this cannot happen. This includes fuses and circuit breakers, plus coolant run through battery packs to keep them at a low temperature.

In this paper there is simple construction of electric vehicle with using rechargeable batteries. There are some sections about their description, working and design, and developing the vehicle for garbage collector at optimum cost.

### II. LITERATURE REVIEW

In “An Enhanced Simulation Model for Dc Motor Belt Drive Conveyor System Control” review a belt drive conveyor system (BDCS) is a typical energy conversion system from electrical to mechanical energy. It is widely used in agricultural machines, electric generators, robotic arms, machine tools, and textile machines by Andomachi G. Katsioulas et al[1]. This “Development of An Economical Digital Control Method For A Continuously Running Conveyor Belt” paper illustrates the functioning of a stop controlled conveyor belt using an LDR sensing arrangement, an easier and economical way of controlling a normally running conveyor belt. Rubber type conveyor belt is used in this analysis since it is more commonly used and cheaper [2]. A simulation model for a belt drive conveyor system is developed and bestowed during this paper. The model is able to take into account the inherent high non-linearity imposed by the real world's system such as friction, vibration and resonance components[1]. In this paper discuss the main advantage of a stepper motor is the ability to realize precise positioning and speed control without applying feedback (speed, position) [3]. Limited use of stepper motors is power and speed, but in practice their use is fully justified in inexpensive machine tools with a CNC system designed for processing wood, plastics, light metals and other medium speed materials[3].

### III. DESIGN OF SYSTEM

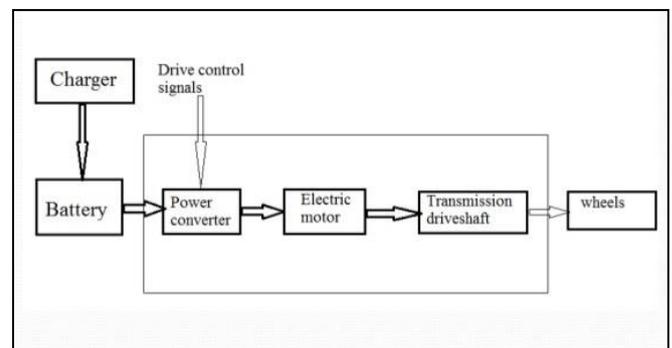


Fig. 1: Schematic diagram of proposed system

Through charger battery stores the electricity which is necessary for running of vehicle. Battery which stores the energy in DC form but majority motors which run on AC hence there is need of energy conversion, hence it is converted into AC form. The Battery supplies electric current

to the motor. The which is going we use is of higher energy density. Control unit which performs the main task, for controlling activities of all component. In this way, after running the motor, it drives wheels of vehicle and vehicle move.

The electrical vehicle drive system includes:

- 1) Electric motor
- 2) Differential
- 3) Power electronics
- 4) Battery
- 5) Control unit
- 6) Charging contact for external charging
- 7) External charging source

Energy source	Vehicle type	Propulsion Device
Gasoline	Internal combustion engine vehicle	Engine
	Micro Hybrid electric vehicle	
Electricity	Mild Hybrid electric vehicle	Electric Motor
	Full Hybrid electric vehicle	
	Plug in hybrid electric vehicle	
	Race exertion vehicle	
	Plug in electric vehicle	
Hydrogen	Fuel cell vehicle	

Table1. Classification of Electric vehicles

The Electric vehicle drive system includes:

- 1) Electric motor
- 2) Differential
- 3) Power electronics
- 4) Battery
- 5) Control unit
- 6) Charging contact for external charging
- 7) External charging

#### IV. BATTERY SELECTION

An electrical vehicle battery or traction battery used to power the propulsion of battery electric vehicle. The have used is rechargeable battery. The starting, lighting and ignition batteries are different than that of electric vehicle batteries, because that kind of batteries are being used for constant periods of time.

An electric battery is a device which consist of one or more electrochemical cells provided to electric vehicle. When a battery is supplying electric power, its positive terminal is positive and negative terminal is anode. The terminal marked negative is the source of electrons that will flow through an external circuit to the positive terminal. The working principle of battery is based on electrochemical reaction and electromotive force. Batteries have lower specific energy than that of a common fuels such as gasoline. Batteries convert chemical energy directly into electrical energy. Electric vehicle batteries are quite different than that of used in laptops and cell phones. They have to handle high power and high energy capacity within limited weight and space and at an affordable price.

#### A. Types of rechargeable Battery:

There are different types of batteries, these are differentiated by the materials used for the electrodes and electrolytes. Lead acid, nickel-cadmium, Nickel- Metal Hydride and lithium-ion batteries these are examples of batteries which being commonly used. We have used the lead acid battery for the electrical car.

Lead -acid		Nickel - Metal Hydride	Li-on	Ultra-capacitor
40	Energy density Watt hour/kg	70	110	5
500	Cycle life	800	1000	500,000
-30 ~ +50	Working temperature	-40 ~ +50	-40 ~ +60	-40~+85
1000	Cost\$/Kilowatt hour	2400	5000	50000

#### B. Why we selected lead-acid battery:

- 1) It is having longest life cycle.
- 2) It offers low self-discharge, which is lowest among rechargeable batteries.
- 3) It gives good performance at low and high temperature.

#### 1) Battery management system:

By number of battery cells battery system is formed. Battery system is connected in series or parallel or series according to design. Every cell should be regulated and monitoring. Voltage, current and temperature these are the parameters which conditioning monitoring system includes. For control and protection purpose measured parameters are used for decision purpose.

Usually two parameters are provided, state of health and state of charge .State of charge is like the oil tank meter that provides the battery charging condition and that is measured by the information of voltage and current. To record the health or ageing condition state of health is used.

$$\text{State of Health} = (\text{Nominal Capacity} - \text{Loss of capacity}) / \text{Nominal Capacity}$$

#### 2) Charging network:

The charging method of Electric vehicle is controversial because of the uncertainty of the power needed, charging time and location. I the recent development, the charging time of batteries has been reported to be shorter.

Generally most of the electric vehicles have an on-board battery charger. A power cable is connected from vehicle to charging point. The charging station should provide a suitable transaction program to calculate the tariff and number of power points.

#### 3) Fast charging station:

A high current is needed for fast charging of vehicle, therefore three-phase power is usually used. Some examples are high voltage power transfer, magnetic contactless charging and battery rental.

#### 4) Electric motor:

We have selected the brushless DC motor for the running of electric car. Electronically commutated motor or synchronous DC motor are another names of brushless dc motor. This motor is powered by DC electricity via an inverter or switching power supply, this produces an AC

electric current to drive each phase of the motor through closed loop controller. The controller gives pulses of current to the motor windings which control the speed and torque of the motor.

The construction of a brushless DC motor system is typically similar to permanent magnet synchronous motor, but can also be a switched reluctance motor, or an induction motor. The advantages of brushless DC motor over brushed DC motors are high power to weight ratio, high speed and electronic control. Brushless motors find applications in such places as hand-held power tools, computer peripherals and vehicles ranging from model aircraft to automobiles.

#### V. ELECTRICAL CALCULATION

For motor selection,

$$P=T*\omega$$

(let us consider vehicle weight is 500Kilogram and Radius of wheel is 0.15 m)

$$\begin{aligned} T &= \text{Vehicle weight} * 9.81 * \text{Radius of wheel} \\ &= 500 * 9.81 * 0.15 \\ &= 735.75 \text{ Newton per meter} \end{aligned}$$

Required speed of electrical vehicle is 25Km per hr,

$$\begin{aligned} \omega &= 6.94 * 0.15 \\ &= 1.041 \text{ rad/sec} \end{aligned}$$

$$\begin{aligned} P &= T * \omega \\ &= 735.5 * 1.041 \\ &= 765.65 \text{ watt} \end{aligned}$$

For battery selection,

For measuring amp hr capacity battery is discharged for continuously 20 hrs and its current output supplied to its standard load is measured.

Suppose that battery delivers,

$$\begin{aligned} \text{Current} &= (\text{Power required for motor} / \text{Voltage of battery}) \\ \text{Current} &= (765.65 / 48) \\ &= 15.95 \text{ ampere} \end{aligned}$$

Hence for 1 hour 15.95 ampere required.

For 20 hrs,

$$\begin{aligned} \text{Amp-hr capacity} &= 20 * 15.95 \\ &= 319 \text{ ampere-hour} \end{aligned}$$

$$\begin{aligned} \text{Watt-hr capacity} &= \text{Voltage required} * \text{ampere hour} \\ &= 48 * 15.95 \\ &= 765.6 \text{ watt-hr} \end{aligned}$$

#### A. Power requirement:

Power required to drive a vehicle at the speed can be calculated from the formula,

$$P = (2 * \pi * N * T) / 60$$

For this calculation we have to calculate rpm of motor first,

Therefore,

Desired top speed,

Let us consider,

$$\begin{aligned} \text{Speed} &= 25 \text{ kilometer per hour} \\ V_{\max} &= 25 * (5/18) \\ &= 6.95 \text{ meter/second} \\ V_{\max} &= R_w * N * 0.10472 \\ 6.95 &= 0.15 * N * 0.10472 \\ N &= 442.44 \text{ rpm} \end{aligned}$$

(Let us consider Torque of vehicle is 19.87N-m)

$$\begin{aligned} P &= (2 * \pi * 442.44 * 19.87) / 60 \\ &= 920.62 \text{ watt} \end{aligned}$$

So conclusion is that selection of motor is about 1.5HP

#### VI. CONTROLLER

A motor controller is device or group of devices or group of devices that gives to govern in some predetermined manner the performance of an electric motor. A motor controller can work with a manual or automatic means for starting and stopping the motor, regulating the speed, protecting against overloads and faults. Controller having ignition switch wire, accelerator connection, motor sensor connections, battery terminal connections, forward reverse switch, speedometer and indicator connection, power supply connections for motor.

#### VII. DIFFERENTIAL

A differential is a gear train having three shafts which is having property that the speeds of the speeds of others is the rotational speeds of one shaft, or a fixed multiple of that average.

The outer drive vehicle rotate faster than inner drive wheel during turn, which is allowed by differential in automobiles and other wheeled vehicle. The average of the two driving wheels equals the input rotational speed of the drive shaft. If speed of one wheel is increases and decreases that of other.

#### VIII. WHEEL

A wheel is a circular component that is intended to rotate on a bearing.

#### IX. CHASSIS OF VEHICLE

##### A. Survey of chassis-

The chassis of car is a skeleton frame made up of pipes and other materials of various cross sections. The car chassis should be consisting of stability, torsional rigidity, as well as it should have relatively high degree of flexibility. It is having sufficient strength to sustain load of operator and other accessories. For convenience and safety of operation chassis is designed.

We have used in design thick section so that bending operation of the material use should be easier. A ladder frame is a type of vehicle chassis which is designed.

#### X. BRAKING AND STEERING SYSTEM

The braking of a vehicle is based on disc brake in past which is mechanical system. The braking method of an electric vehicle should be integrated with both electrical braking and mechanical. At the starting region of braking pedal, it electrical power regeneration braking should be applied. This is generally for going down a slope or deceleration, the kinetic energy of the vehicle can be returned to the battery. This gives a compromise of the safety and energy saving.

Now a days, we can make motors with high power of regeneration that is in the expenses of the motor cost, weight, power regeneration efficiency and safety are needed.

Steering is achieved by varying the speeds of the lines of wheels on different sides of the vehicle in order to induce yaw.

#### XI. SUSPENSION

The developed direct drive linear motor actuator for the automobile active suspension system can generate control suppress the roll, forces to absorb road shocks rapidly and pitch motions, and ameliorate both safety and comfort, vehicle while maintaining at horizontal level.

#### XII. OTHER ACCESSORIES

The front lighting system is of Led and adaptive front lighting system is a security lighting system in vehicles.

#### XIII. FUTURE SCOPE

By using electricity from solar panel, we can charge the vehicle battery.

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