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Fabrication of Light Weight Electric Powered Vehicle & Its Estimating & Costing

Mohd Salahuddin[1],Taleb Ahmed Mansoori[2], Mirza Munawar Baig[3], Mohammed Siddique Ahmed[4]

[1]*Student,Mechanical Engineering Department, Sreyas Institute Of Engineering & Technology, Nagole, Hyderabad-50068*

[2]*Student, Electrical Electronics Engineering Department, Methodist College Of Engineering & Technology, Osmania University Hyderabad,* [3]*Student, Electronics And Communication Engineering Department, Sreyas Institute Of Engineering & Technology, Nagole, Hyderabad,* [4]*Student, Technische Hochschule Ingolstadt Germany, Master In International Automotive Engineering*

Abstract: ***In definition of an electric car or the vehicle is an automobile that is propelled by one electric motor or more, using electrical energy which is stored in batteries or another energy storage device. Electric motors give electric cars, instant torque, and creating strong and smooth acceleration. Electric vehicles are being introduced to the passenger in the market in addition to reduce pollution which will have a good impact on the society. In this vehicle we are using batteries in spite of using the fuel systems. The motor used for power system in the electric power vehicle is having less cost and light in weight when compared to the other system vehicles. By using the electrical system there is huge advantage to the society in the economical ways as well as in the production manner. Such there initially there is no corrosion, because of the absence of the metallic items also there will be no leakage of fuel in the engine. It can overcome the hazards such as corrosive chemical, toxic fumes, fire and electric shocks in the events of crush and bring safety to the user as well as the engineer during manufacturing.***

I. THEORY

The Australian new car assessment program (ANCAP), us insurance institute for high safety (IIHS) and Euro NCAP has conducted 64km/hr frontal offset crash tests since the mid of 1990's. Japan NCAP and Korean NCAP also conduct this test. These organizations have also conducted 29km/h side pole tests on many vehicle models. Almost all the tested vehicles have had conventional fuel systems(petrol or diesel). There have been several cases where there has been a fuel leak due to disruption of fuel lines or rupture of the fuel tank.utf the hundreds of crash tests ANCAP has experienced one minor fire, where an electrical short ignited some foam plastic insulation near the crushed radiator. Another post crush hazard conventional vehicles is leakage of battery acid.. fully reviews those potential hazards and provides advice for minimizing risks. It is stressed, however, that experience with electric vehicles is limited and that this advice will need to be reviewed as more information becomes available. It is also acknowledged that vehicles manufacturers have put considerable resources into developing safe and reliable electrical systems for the current generation of electric vehicles. A serious incident involving Lithinium-ion car battery is considerable to be highly unlikely but it is important that crush test organizations and rescue organizations understand and are prepared for the potential hazards.

A. Process Involved In Fabrication

Basic process of light weight electrical four wheeler: the battery power of electrical energy is converting into the mechanical energy with the assist of chain and sprocket, and sue to this however, it is eco-friendly, low maintenance and low initial cost and the big advantage is that it is light in weight. Basic structure: chassis: the chassis of an automobile consists if following components suitably mounted, transmission system, rear axle, road wheels, steering system and all the components listed above are mounted in either of two axis ways, viz. the conventional construction in which a separate frame is used and the frameless or unitary construction in which no separate frame is employed. Out of these, the conventional type of construction is being used presently only for heavy vehicles whereas for the car the same has been replaced by the frameless type.

B. Types of chasis

1) Convention Control Chassis: in these types of chassis the engine is mounted in front of drivers cabin. This type of

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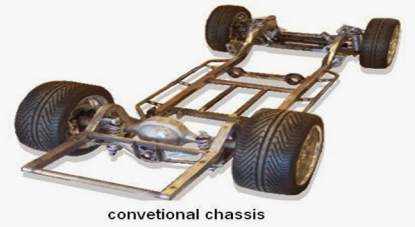
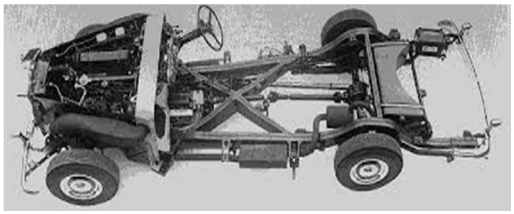
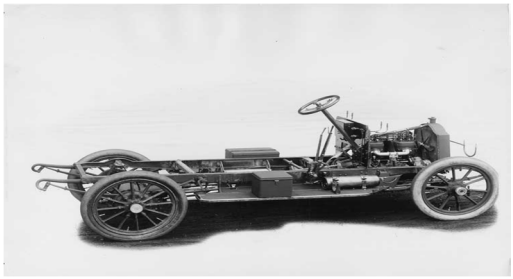
arrangements avoids full utilization of space.



2) *Semi forward Control Chassis:* in which engine is mounted that half of it is in drivers cabin whereas the other half is in front outside the drivers cabin. TATA SE series of vehicles are the best example for this type of chassis.



3) *Full Forward Control Chassis:* in which the engine is mounted completely inside the drivers cabin obliviously maximum utilization of space is achieved in this type of arrangements. TATA series is also an example for this type of forward control chassis.



4) *Ladder type chassis:* this is the early kind of the chassis nearly all the cars in the world used it as the standard even in the today life, most sport vehicles still employ it. Its construction, indicated by its name, look like a ladder two longitudinal rails interconnected by several lateral and cross braces. The longitudinal member or main stresses member. The delay with the also the longitudinal caused the acceleration and bracing. That lateral and cross members provides resistance to lateral forces and further increases tensional rigidity.

Advantages of this type chassis: it is easy in construction, It is cheaper than other chassis. However, it possess disadvantage since it is a dimensional structure, tensional rigidity is very much lower than other chassis, especially when dealing with vertical loads or dumps.

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C. Power Source

1) *Introduction Of Battery*: Batteries are widely used of direct current. Electrical energy in automobile, boats , mines, air craft's, ships, portable electric or electronic equipment's,& lighting equipment's in some instants they are used as the only source of power which in other ,they are used as a secondary or ward by power. It consists of a number of cells assembled either in series or parallel. And it is used as common container and connected to functions as a source of electrical power. In ancient period there are different types of cells and batteries has been comparatively low. Now a day's many types and sizes of cells and batteries are in use. This came in existence because many electrical and electronic devices are invented for the average man. Science and technology, medicine and other field. Battery cells are made in many shapes, sizes of electrical loads from heavy duty to low drain and intermittent service.
2) *Storage Of Batteries:* A cell is a source of EMF in which chemical is converted into electrical energy. A battery cell essentially consist of 3 active materials
   a) Positive electrode
   b) Negative electrode
   c) Electrolyte and container

Battery plays a important role in many in industries and commercial applications, example: transistor radios, telephone exchange electrical substation, generating stations, mines etc. Accumulator is a term sometimes applied to a storage battery.

3) Use of storage batteries

a) Automobile lighting and starting b) Telephone and exchange c) To run electrical vehicle d) Lightning of stem railway trains. e) Emergency lighting. f) Coal mines g) Laboratories. h) Hospitals i) Broad casting stations j) Submarines.

4) Charging of batteries: For charging storage batteries, D.c supply is required supply is A.c it should be converted into dc by some means such as rectifies

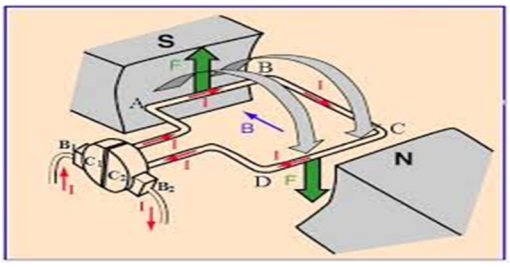
There are two methods used for charging batteries.

a) *Constant current method:* In this method current will constant .voltage will be varied. This is accomplished by Oppressively reducing the variable resistance.
b) *Constant voltage method:* in this method voltage of battery is kept constant but it result is very large charging current in the beginning when the BACK E.M.F of the battery if low.

5) Battery specification: the specification of the battery is equal to the lemon-xsmf auto motive battery(scaled calcium premium battery)

Volts = 12v
Capacity=120dimension in mm= 506 into 18 into 233
Plate per cell =21
Weight=32kg

D. Motor



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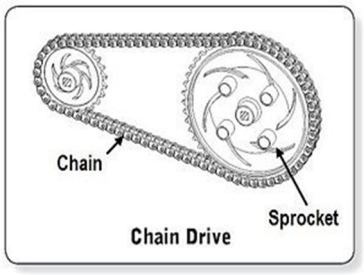
E. The transmission system

1) Chain and sprocket 2) Rear axle

Chain and sprocket: sprocket and chain are used where a definite velocity ratios is to be rewuired belt drive is a negative drives and chain drive are the positives drives. The chain drive consists of an endless chain running over two sprockets keyed the shaft. Chain drives transmit motion between parallel shaft only, and at shortly distance of 5-8 than a belt drive.



a) Types of chains:

i) Roller chain

i. the chain rollers are used b/w connecting links and rotate freely on bushes
ii. the distance B/w to consecutive pins must be equal to pitch (p) of the sprocket wheel
iii. the chain is used for trucks as well as for power generation

ii) Inverted tooth or silent chain

i. Silent is used when maximum quietness is desired and where it is necessary to transmit heavier loads
ii. It consists of a hooked from of link , made of stamping from steel sheet
iii. We are using Inverted or silent chain. because of speed is 350m/min to 450m/min and the velocity ratio 12:1
iv. Efficiency is high
v. Lubrication is simple

b) Chain Length Calculation

The following equation may be used to determine the chain length required for any two-sprocket drive.

L=2C+N+n+.1013 (N—n)02

Or substituting A for .1013 (N — n) 02,

L=2C+N+n+A

Where:

C = Shaft Center Distance in pitches,

L = Length of chain in pitches,

N = Number of teeth in larger sprocket,

n = Number of teeth in smaller sprocket, 7t = 3.141 6,

A = Value from table below tabulated for values of N-n,

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P = Pitch of chain.

NOTE: The method described with above table of constants is sufficiently accurate practically all commercial chain drives.

F. Sprocket and sprocket Nomenclature

Sprocket are used to transmit power from one end to the end of the shaft through chain. The sprockets are generally made up of raw material as cast iron. Sprocket nomenclatures Provide the chain pitch written to the Left of the hub style code letter followed by the number of teeth in the sprocket. If the sprocket is to be multiple strands. The prefix code letter is added to the beginning of the part number. A suffix of H is added if the teeth are to be heat treated. If the sprocket is to be bored for either QQ or taper bushed, the center hub letter is changed. For QD style the letter designation of the bushing is used in lieu of the hub style code. If a taper bushing is to be used, the two letter TB are added behind the huh code letter. In some instances. The material a sprocket is to be manufactured from will be added into the part number as a suffix.

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For example**:**

SS - Stainless Steel Material.

NM- Non-Metallic.

BR - Brass or Bronze Material,

CD - Cadmium Plated.

Zi - Zinc Plated.

Ni - Nickel Plated.

CH - Chrome Plated.

If the part is to be used with a shear pin device, the center hub style letter is substituted with an sp. Most manufacturers of sprockets conform to the ANSI (American Standards Institute) and conform to the Type H tooth form as given in the standard B29.1 - 1975. It is not necessary to show detailed tooth information on sprocket drawings, just specify ANSI standard tooth form.

G. Speed control of D.C shunt motor

The speed of a shunt motor can be changed by

1) Flux control method
2) Armature control method
3) Voltage control method. The first method (i.e. flux control method) is frequently used because it is simple and inexpensive.

H. Flux control method: It is based on the fact that by varying the flux f, the motor sprrd (N µ 1/f) can he changed and hence the flux control method. In this method, a variable resistance (known as shunt field rheostat) is placed in series with shunt field winding the shunt field rheostat reduces the shunt field current Ish and hence the flux (f) Therefore, we can only raise the speed of the motor above the normal speed Generally, this method permits to increase the speed in the ratio 3:1. Wider speed ranges

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tend to instability and poor commutation.

1) Advantages

a) This is an easy and convenient method.

b) It is an inexpensive method since very little power is wasted in the shunt field rheostat due to relatively small value of lsh.

c) The speed control exercised by this method is independent of load on the machine.

2) Disadvantages

a) Only speeds higher than the normal speed can be obtained since the total field circuit resistance cannot be reduced below Rsh—the shunt field winding resistance.

b) There is a limit to the maximum speed obtainable by this method. It is because if the flux is too much weakened, commutation becomes poorer.

I. Speed Control of D.C. Series Motors:

The speed control of D.C. series motors can be obtained by

J. Flux control method:

in this method, the flux produced by the series motor is varied and hence the speed. The variation of flux can be achieved in the following ways:

1) Field diverters: In this method, a variable resistance (called field diverter) is connected in parallel with series field windings. Its effect is to shunt some portion of the line current from the series field winding, thus weakening the field and increasing the speed (Q N µ 1/f). The lowest speed' obtainable is that corresponding to zero current in the diverter (i.e., diverter is open). Obviously, the lowest speed obtainable is the normal speed of the motor. Consequently, this method can only provide speeds above the normal speed. The series field diverter method is often employed in traction work.

2) Armature diverter: In order to obtain speeds below the normal speed, a variable resistance (called armature diverter) is connected in parallel with the armature. The diverter shunts some of the line current, thus reducing the armature current. NOW for given load, if la is decreased. the flux f must increase (Q T 1.1 fla). Since N µ 1/f, the motor speed is decreased. By adjusting the armature diverter, any speed lower than the normal speed can be obtained.

3) Tapped field control: In this method, the flux is reduced (and hence speed is increased) b: decreasing the number of turns of the series field windings. The switch(S) can short circuit an part of the field winding, thus decreasing the flux and raising the speed. With full turns of the feel, winding, the motor runs at normal speed and as the field turns are cut out, speeds higher than normal speed are achieved.

4) Electric Braking: Sometimes it is desirable to stop a d.c. motor quickly. This may be necessary in of case emergency or to save time if the motor is being used for frequently repeated operations. The motor, and its load may be brought to rest by using either (i) mechanical (friction) braking or (ii) electric braking. In mechanical braking, the motor is stopped due to the friction between the moving parts of the motor and the brake shoe i.e. kinetic energy of the motor is dissipated as heat. Mechanical braking has several disadvantages including non-smooth stop and greater stopping time in electric braking. The kinetic energy of the moving parts (i.e.. motor) is converted into electrical energy which is dissipated in a resistance as heat or alternatively, it is returned to the supply source (Regenerative braking). For D.C. shunt as well as series motors, the following three methods of electric braking are used:

a) Rheostat or dynamic braking

b) Plugging

c) Regenerative braking

It may be noted that electric braking cannot hold the motor stationary and Mechanical braking is necessary. However, the main advantage of using electric braking is that it reduces the wear and tear of mechanical brakes and cuts down the stopping time considerably due to high braking retardation.

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K. Cost estimation

After developing the conceptual fabrication of the vehicle cost and estimation is prior requisition for any designer. Cost of following constituents

1) material cost 2) machining cost 3) labour cost 4) indirect cost5) total cost

Material cost is estimated by calculating the volume of ech part and it is with the density of the material, we get the weight of the material, and we get the cost os the material per kilogram in the market. For example mild steel is rs 40/kg and AL alloy costs rs70/kg etc. multiplying the weight with these cost gives the material cost; to this add the handling charges to get the final material cost.

Material cost Rs- 3000

Parts cost= 9000

Machining cost: machining cost depends upon the size of the machining required. The hourly rates of the machine will be 2 to 3 times higher than the rate of the smaller machine. The hourly rate of the turning should be 2 to 3 times higher than the rate of the smaller machine. The hourly a=rate of the turning should be higher than that of drilling and for precision grinding even more, it is calculated as machining time in hours multiplied by hourly rate of labor generally, hourly rate of the machining is Rs 50/- per hour. Total time required for the various machining process i.e turning drilling Welding et.

Turning cost is Rs- 1000

Welding cost is Rs-500

Drilling cost is Rs- 500

Labor cost:- it is the cost of remuneration (like wages, salaries) of the worker.

Labour cost Rs-5800

Indirect expenses all the expenses other than the material cost , labour coast and the machining cost comes under this group and the transportation cost plays a vital role that is equal to 10000

Total cost:- the sum of the material cost, machining cost, labour cost and the indirect expenses

Total cost= 3000+9000+1000+500+500+5800+10000=29,800/-

L. Result

Fabrication of the light weight electric powered vehicle is successfully completed.

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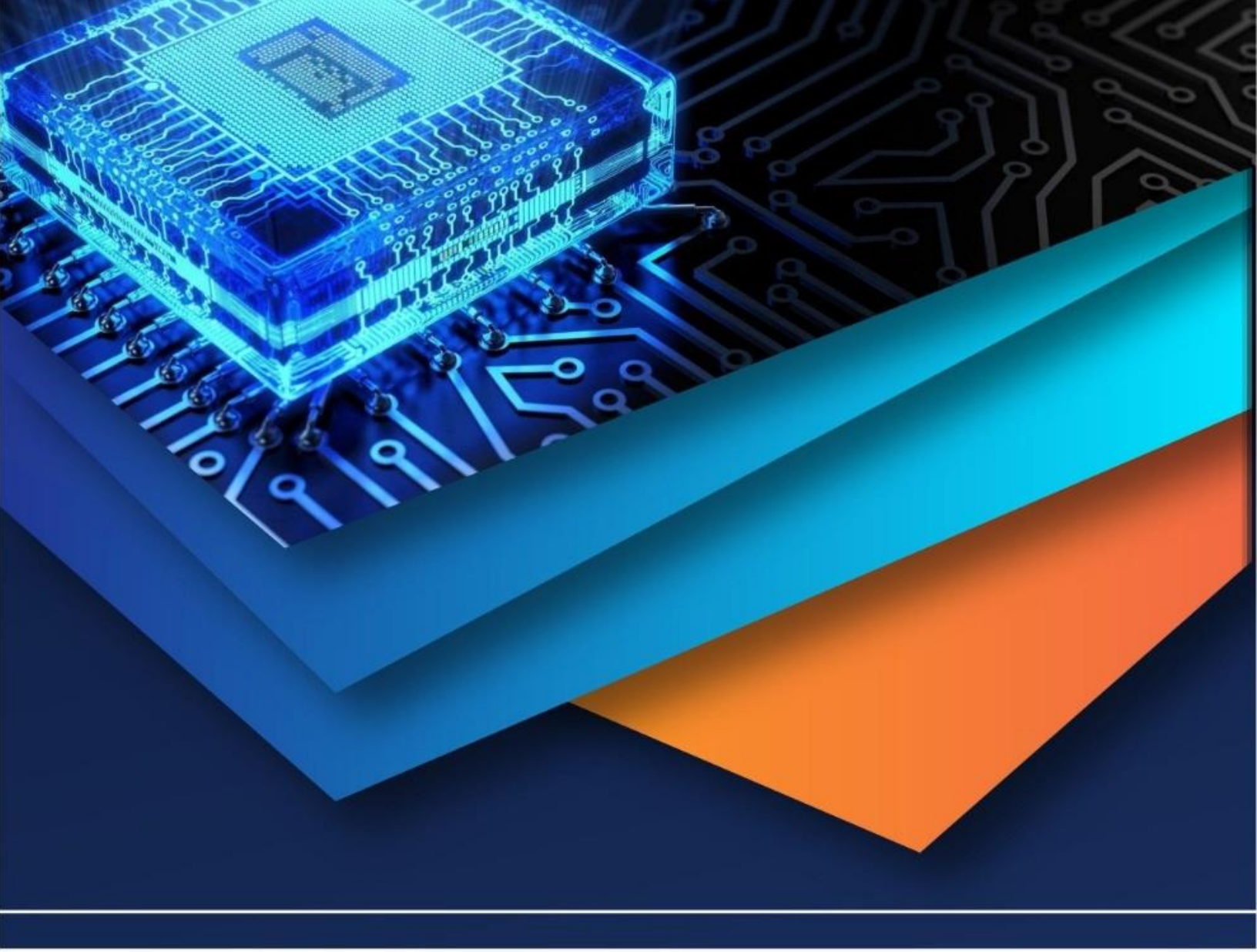

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