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Design and fabrication of Electric Car Using PVC Pipe

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***Abstract*— This paper discuss the concept of "Electric Go-kart" as we are aware about Global Warming its harmful effects of Greenhouse gases like carbon dioxide, methane, nitrogen oxide and some artificial chemicals, because of Industrialization and mass of vehicles on road. In order to dealt with this problem an evolution called "Electric Vehicle" came into existence. Therfore our paper deals with electric vehicle features using PVC pipe electric cart. This car practices use of non conventional energy sources, along with pipe good strength. We are given the name of the project Electric Car Using PVC Pipe. It is light in weight, easy to control and it is economical. It is practice for travelling short distance, for fun drifting, for f1 car racing, luggage carrier purpose, used in big temples and used in industries.**

Keywords*— *Electric Vehicle, DIY PVC, Renewable Energy Sources

1. INTRODUCTION:

My research paper describes about the "Electric Car Using PVC pipe" which is based on the concept of electric Go-kart. Go-kart is simple design model. It have four-wheeled, two DC electric motor, single seat racing car. They were initially created in the 1950s. Post war period by airmen as a way to pass liberty. Art generally accepted to be the creator of karting. He built the first kart in 1956 in Southern California. From them, it is being famous all over America and also Europe. A Go-kart, by definition, has no differential and no suspension. This type of car usually raced on scaled down tracks, but are Practices in driven entertainment, fun drifting or as a hobby by non-professionals. In this car the chassis consist of PVC pipe. This project practices non conventional energy sources, along with PVC (Polyvinyl Chloride) pipe having tensile strength which can be calculated by hanging weight from the pipe until it bends for cracks. PVC (Polyvinyl chloride) is very dense compared to most plastics CPVC and hard rigid PVC has extremely good tensile strength. PVC is rigid and hard. Its ultimate tensile stress is nearly 53 MPa at 20°C.

Fig.1 Electric Car Using PVC Pipe

2. ELEMENT OF THE PROJECT

2.1 FRAME

The project required frame to be strong because Electric Cart need to carry at least 100 kg load to accountfor one passenger. In the design parameter we have chosen pvc pipe which cannot bear too highload and high weight capacity so we indulge steel/wooden frame below the pipe frame because it is

easier to weld than other materials such as aluminum.

Fig.2 Chassis

2.2 STEERING

Steering is a very essential mechanical aspect of any vehicle which provides the direction of the vehicle a steering linkage similar to that on a colleague's go- kart, Shane Colton. It works with attaching each and every wheel to a steering rod, and connecting each rod to a part on the end of the steering wheel. When the steering wheel turns, the part on the end also rotates, pushing one steering rod away while pulling the other rod closer. For two wheel steering, we practices Ackermann steering geometry in this vehicle.

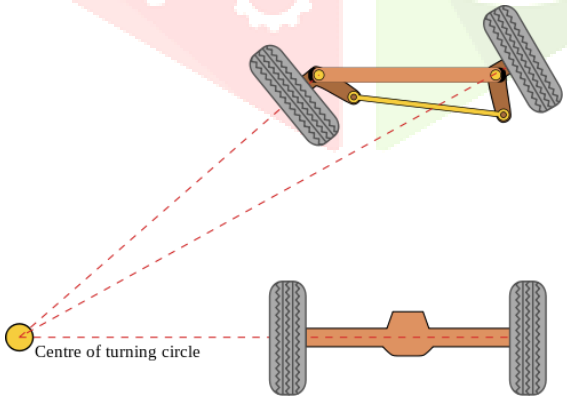

Fig.3 Ackermann steering geometry

2.3 MOTOR

In this project we employed t w o s e t s o f 12V 7Amp DC geared wiper motor.

- For all vehicles the driven train is a fundamental engineering problem. The drive train consists of the Wiper geared motor, transmission along with other drive wheels.
- Drive train components need to be fitted robustly and operate efficiently to be effective and safe.
- The design of the frame is such that a motor could be easily installed to the steel tubing.
- For the DC Wiper motor it would onlybear single installing plate to secure.

Fig.4 Transmission system

2.4 BATTERY

In electric vehicle we have practices 12v Lead Acid Battery. Lead acid batteries are low cost definitive power workhorse used in heavy duty applications. It is the oldest type of rechargeable battery. It can be charge again and again and still very relevant and important into today's scenario Lead acid batteries have very low energy to weight and energy to volume ratios..

- Type: Offline/Standby
- Output Power Wattage: 560 W
- Input Voltage: 12 V, Output Voltage: 12 V
- Input Frequency: 50hz|Output Frequency: 50hz
- W x H x D: (25x18x18) in cm

Fig.5 Led Acid Battery

3. CALCULATION

3.1. DESIGN PARAMETER OF CPVC PIPE

Internal Pressure acting inside the pipe,

$s = p \times (d - 1)\ 2 \times t$

Where, s = circumference stress (in psi)
p = Internal pressure (in psi)
T = wall thickness (in inches)
d = outer diameter

Let Circumference stress = 35 psi
t = 0.157 inches
d = 1.338 inches

Hence, $35 = p \times (1.338 - 1)2 \times 0.157$
$p = 32.514$psi

a) DESIGN STRESS

$L = \sqrt{}\ 3E \times D\ (\Delta L)\ 2 \times S$

Where, L = loop length (in inches)
E = Modulas of elasticity (in psi)
d= Outer diameter of pipe
s= Working Stress (in psi)
Δ L = change in length (in inches)

Hence $\sqrt{}3 \times 0.118 \times 1.338 \times 0.059$
2×0.393
s = 0.188psi

3.2) MODEL DESIGN:-

Weight= 60 kg , efficiency= 65%, wheel size=19.5inch,
wheel radius= 9.75 inch (0.24765 meter)
Length= 1200 mm
Width= 600 mm
Area= $1200 \times 600 = 720000\ mm^2 = 0.72\ m^2$

Speed= 15 km/h = $15 \times 1000/3600 = 4.2$ m/s

a) LINEAR DISTANCE TRAVELLED:-

L.D.T. = $2 \times \pi \times r$
$= 2 \times \pi \times 0.24765 = 1.1556$ m

b) R.P.M.:-

R.p.m .= Total distance covered/hour / Linear distance
$= 15 \times 1000/(1.1556 \times 60)$
= 217 r.p.m

b) POWER:-

Power = [(Mass in kg)×(Acc^n gravity)×(Velocity in m/s)×R_R]
+ [Air density ×C_d× Area(m^2) × Velocity (v^3)]
=[60×9.8×4.2×0.01] + [0.6465×0.88×0.72× $(4.2)^3$]
= 24.696 + 30.35
= 55.046 watt

c) TORQUE:-

Efficiency= 65%
Efficiency= $P_{(out)}/P_{(in)}$
$P_{(out)}$ = efficiency × $P_{(in)}$
Torque × w = efficiency × $P_{(in)}$
W = 2×π×r.p.m./60
W = 2×π×217/60
= 22.72 ~ 24
Torque = 0.65×63.3/24
Torque = 1.714 N-m

d) ACCELERATION:-

Acc^n = Velocity/Time 0 to 15km/h ----------> 10sec (let)
Acc^n = 4.2/10 = 0.42m/s^2

e) FORCE:-

Force= mass × acc^n
= 80 kg × 0.42 m/s^2 = 33.6
= 34 kgm/s^2

3.3 CALCULATION OF BATTERY:-

a) How to decide size of battery (Ah) ?
b) Requirement:- distance/charge & at what speed
Suppose:- (40 km/ charge) at (15 km/h)
Power= 63.3 wattSpeed = 15km/h
Now, suppose 1 hour at 15km/h power consumption= 63.3÷15=4.22wh/km
Now, we have decided to use motor of 24v/36v/48v/72vAh per km = 4.22÷24 = 0.1758 Ah/km

To calculate Ah, we have to multiply with km

$= 0.1758 \times 40 \times (1.25)$

$= 8.79$ Ah

For ;

Lead acid battery:- $8.79 \times 1.8 = 15.822$ Ah

Lithium Ion battery:- $8.79 \times 1.05 = 9.2295$ Ah

4. MERIT, DEMERIT AND APPLICATION

MERIT

- ✓ No requirement of combustible fuels.
- ✓ Lower carbon emissions
- ✓ EV has zero emissions.
- ✓ Less noisy in operation.
- ✓ Maintenance Cost is Low.

DEMERIT

- ✓ It does not bear more than 100kgs load.
- ✓ Batteries are still very expensive and the performance not good. However, charging can be achieved in about 30 minutes and it is possible toswap batteries.

APPLICATION

- ✓ It is useful for travelling small distance purpose.
- ✓ It is also useful for small scale industry.

Fig. 6 Front View

Fig. 7 Top View

Fig. 8 Side View

5. FUTURE SCOPE

- ✓ In future we can add a solar panel on the roof of vehicle and connect the battery with the help of charge controller by which the battery would be charged.
- ✓ We can add a trolley to the back of the car.
- ✓ For increasing strength, stiffness, rigidity, Impact load, toughness we can use nano particle coating and can used graphene coated materials along with carbon nano tubes materials in place of pvc.

6. CONCLUSION

The "Electric Car Using PVC Pipe" is designed for Domestic, Industrial and short distance travelling. In this system the energy is supplied by electrical energy to the DC motor and the motor transform that energy into mechanical energy and motor is attached to the wheels and cart is run. Due to simple design and low cost this can be marketed to any of the nation. Cheap, easy, simple, compact car is obtained. This car is mainly fabricated for cheap and for performing the function of the eco-friendly vehicle for the environment.

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