

Fabrication of Electric Cart using PVC Pipe

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Abstract— As we all are aware Global Warming and harmful effects of Greenhouse gases, which is an effect of Industrialization and mass of vehicles on road. So to overcome this problem an evolution called “Electric Vehicle” came into existence. Hence our project deals with electric vehicle features in a DIY PVC pipe electric cart. This project is development, use of renewable energy sources, and research on pipe strength based.

Keywords: Electric Vehicle, DIY PVC, Development, Strength, Environmental conditions, Renewable Energy Sources, Lifespan, Cracks

I. INTRODUCTION

As we all are aware Global Warming and harmful effects of Greenhouse gases, which is an effect of Industrialization and mass of vehicles on road. So to overcome this problem an evolution called “Electric Vehicle” came into existence. Hence our project deals with electric vehicle features in a DIY PVC pipe electric cart. This project is development, use of renewable energy sources, and research on pipe strength based.

A. Strength of PVC Pipe

PVC pipe tensile strength can be measured by hanging weight from the pipe up until it bends for cracks. PVC is very dense compared to most plastics rigid PVC is very hard rigid PVC has extremely good tensile strength. PVC is hard and rigid within an ultimate tensile stress of approximately 52 MPa at 20°C and is resistant to most chemicals. PVC can be used at temperatures up to 60°C although the actual temperature limit is dependent on stress and environmental conditions.

B. Life of PVC Pipe

The expected lifespan of PVC pipe is 50 to 70 years all the some data provided by plastic pipe manufacturers indicate a possible 100 + real life for the material. Some cracks are seen on PVC pipe after 14 years.

C. Electric Vehicle

An electric vehicle, also called as EV uses one or more Electric motors for traction Motors for preparation and electric vehicle maybe power through a collector system by electricity from of vehicle sources or may be Self-contained with battery solar panels for an electric generator to convert fuel to Electricity. EV’s include but are not limited to road and Railway vehicle, surfaces and underwater vessels, electric aircraft and electric spacecraft.

II. FEATURES OF ELECTRIC VEHICLES

- No requirement of combustibile fuels.
- Maintenance Cost is Low.
- Less noisy in operation.

- Lower carbon emissions.
- EV has zero emissions.

A. Problem Statement

- As we all are very much aware of global warming and harmful effect of greenhouse gases it is an effect of industrialization and mass consumption of vehicles on road show to overcome this problem and evolution called electric vehicle came into existence.
- Electric car using PVC pipe project is an electric d DIY counterpart, of commonly metal build with small gasoline engine Car Vehicle it features a DC motor speed controller and also it consists of high torque DC motor.
- This project illustrates the capability of some basic materials that can be considered for the further development. Also a development related to electric cars supports sustainable energy system.

B. Objectives

- To understand the strength of PVC pipe.
- To design the pipe cart.
- To understand oral concept and functions of electric vehicle.
- To understand and compare the emissions produced by electric car and conventional car

C. Scope

- Can be used as a reference for further development.
- Development related to electric car using renewable energy sources.

D. About PVC Pipe Electric Cart

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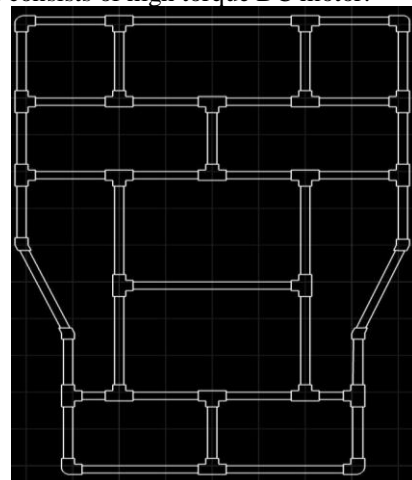


Fig. 1: Layout of PVC Pipe Chassis

This project illustrates the capability of some basic materials that can be considered for the further development. Also a development related to electric cars supports sustainable energy system.

A unique design provides riders with a low center of gravity, hitch makes riding safe, stable and virtually unstoppable, we also use high-quality Pipe and the bottom section (Chassis) is made up of CPVC.

III. WORKING OF ELECTRIC VEHICLE

Electricity is transferred from a battery to a controller. The controller then sends the electricity to the electric motors when needed. The electric vehicle has electric motors instead of internal combustion engine. The accelerator is connected to a variable switch which tells the controller how much power to send to the electric motors. Power output can vary from zero to full as needed. As it runs on electricity, the vehicle emits no exhaust from a tailpipe and does not contain the typical liquid fuel components, such as a fuel pump, fuel line, or fuel tank. The basic design of our project consists of a back section and front section made up of U PVC

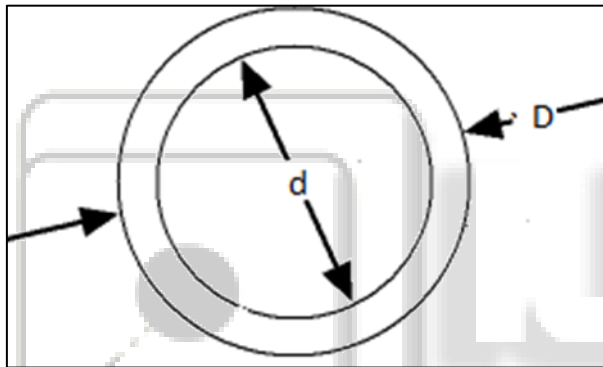


Fig. 2: c/s of PVC Pipe

A. Design Procedures

1) Design of CPVC Pipe

- a) Internal Pressure acting inside the pipe,

$$S = \frac{P \times (D - 1)}{2 \times t}$$

- b)

Where, S = circumference stress (in psi)

P = Internal pressure (in psi)

T = wall thickness (in inches)

D = outer diameter

Let Circumference stress be = 35 psi

t = 0.157 inches

D = 1.338 inches

$$\text{Hence, } 35 = \frac{P \times (1.338 - 1)}{2 \times 0.157}$$

P = 32.514psi

b) Design stress

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

Where, L = loop length (in inches)

E = Modulus of elasticity (in psi)

D = Outer diameter of pipe (in inches)

S = Working Stress (in psi)

ΔL = change in length (in inches)

$$\text{Hence } \frac{\sqrt{3 \times 0.118 \times 1.338 \times 0.059}}{2 \times 0.393}$$

$$S = 0.188\text{psi}$$

B. Fabrication

Fabrication is the building of overall structures by cutting, bending, and assembling processes. It is a value added process that involves the creation of machine parts, and structures from various raw materials. The raw materials we used

For fabrication with their dimensions are as follows:

- 1) Front And Back Section Of Cart
- 2) U-PVC Of nos. 4 - 20foot
- 3) Bottom Section Of Cart (Chassis)
- 4) CPVC Of nos. 3 - 20foot

C. Body Parts

1) Basic Frame

The basic frame of our project consists of a front section and back section is made up with U- PVC. The bottom section made up of C-PVC pipe which support the car. The pipe is attached to the frame by using bolts. The support is given at the four points to avoid chances failure. The chassis supports to the base plate. The top side of frame is joint with the elbow and "T". The upper body is also drilled according to the projection of the drilled sections. The upper plate is detachable with help of nut bolts. All the components are mounted on the base plate. The upper plate is made detachable for easy access to the parts mounted on the base plate.

2) BLDC Motor

The BLDC motor of 48v 750W high torque motors is used.

- RPM-750
- Rated voltage-48v DC
- No load current-600mA
- Stall torque-28 kick

We have used two of these motors for the two respective rubber wheels. The motor is fixed to the back side of car. The motor is fixed with the help of nut and bolts. The motor is attached to the chain socket which rotates and rotates the wheels. The motor speed is controlled by the accelerator provided on front side of car.



Fig. 3: BLDC Motor

3) Electric Drive

System employed for motion control is called drives it may employ any of prime movers for supplying energy for motion controls. Drives employing electric motors are called as electrical drives. A drive is a combination of various systems combined together for the purpose of motion control.

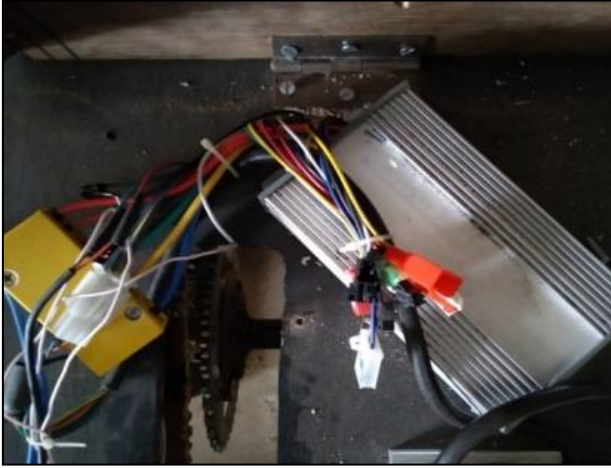


Fig. 4: Electric Drive

4) Lead Acid Battery

The lead–acid battery was invented in 1859 by French physicist Gaston Planté and is the earliest type of rechargeable battery. Despite having a very low energy-to-weight ratio and a low energy-to-volume ratio, its ability to supply high surge currents means that the cells have a relatively large power-to-weight ratio. These features, along with their low cost, make them attractive for use in motor vehicles to provide the high current required by automobile starter motors.



Fig. 5: Lead Acid Battery

5) BMS Circuit

BMS circuit is a Battery Management Circuit. We have installed BMS circuit in our battery; the purpose of the BMS circuit is to control the flow of electricity according to loading conditions and also to cut off the flow when the battery is fully charged to avoid short circuits. A battery management system is any electronic system that manages a rechargeable battery (cell or battery pack), such as by protecting the battery from operating outside its Safe Operating Area, monitoring its state, calculating secondary data, reporting that data, controlling its environment, authenticating it and/ or balancing it.

D. Protection of Circuit

A BMS may protect its battery by preventing it from operating outside its safe operating area, such as:

- .Over-current (may be different in charging and discharging modes)
- .Over-voltage (during charging)
- Under-voltage (during discharging), especially important for lead-acid.
- Over-temperature
- Under-temperature
- .Over-pressure (NiMH batteries)
- Ground fault or leakage current detection (system monitoring that the high

1) Rubber Tire



Fig. 6: Rubber Tires

We have used rubber tyres of size 200/50-100. Four tyres are used in our project. Each tyre can carry maximum load up to 200kg.

E. Analytical Approach

Following stages:-

- Stage No. 1

First of all we searched for a project idea, we found some information about PVC Pipe Go Cart, and we were interested in making of such model. So, we decided to make working model. We gathered information about its aim, objectives, advantages, etc.

- Stage No. 2

After finalizing the project idea we started to plan that how we are going to manufacture the model. First we designed the project with all actual dimensions. Then we gathered information about all the material required.

- Stage No. 3

After this process, we purchased all the material required according to the dimensions. Then, we started to first fabricate the basic body of our project. After Completing the machining processes we coupled all the parts on the base plate, according to the proper dimensions. We divided all the activities amongst the group members.

- Stage No. 4

After completing the total fabrication work we assembled all together and tested the Cart in practical condition.

IV. MANUFACTURING PROCESSES

A. Welding Process

Welding is a fabrication or sculptural process that joins materials, usually metals or thermoplastics, by using high heat to melt the parts together and allowing them to cool causing fusion. Welding is distinct from lower temperature metal-joining techniques such as brazing and soldering, which do not melt the base metal. In addition to melting the base metal, a filler material is typically added to the joint to form a pool of molten material (the weld pool) that cools to form a joint that, based on weld configuration (butt, full penetration, fillet, etc.), can be stronger than the base material (parent metal).



Fig.7: Welding

B. Vertical Drilling Machine

We have used vertical drilling machine for drilling holes in the rectangular cross section. We also used the machine to drill the holes in the top plate according to the projections of rectangular cross section.



Fig. 8: Vertical Drill

C. Grinding Machine

We used the grinding machine to cut the hollow mild steel pipe for providing ventilation to driving motors and also to reduce the weight. We used the grinding machine to cut the square bars according to the dimensions.



Fig. 9: Grinding

D. Cutting Process



Fig. 10: Cutting

Cutting processes applied for cutting of metal rods, pvc pipes, different metal rods used in project.

E. Experimental Approach

(Test performed and result)

Experimental Setup for Testing Performance:

1) To check the proper functioning of machine, we performed the experiment on it

- a) Load test for load carrying capacity of car
- b) Speed test for maximum speed checking

2) First we measure the group member's weight by using weight machine

3) Then one by one we stand on the vehicle and measure the capacity

4) For second test we run the vehicle and by using "speedometer"

Result obtained:

a) Load Test

Result obtained by load test carried out is the vehicle is able to gain load up to 200 kg.

b) Speed Test

Result obtained by speed test carried out is that the vehicle is reached maximum speed. Up to 25km/hr.

F. Merits, Demerits & Application

1) Advantages of PVC Pipe Electric Car

- No fuel is required.
- Electric car give off no emission.
- Electricity required is less.

2) Disadvantages of PVC Pipe Electric Car

- Price of electric car is high.
- Even though it is quite ride, silence can be seen as a disadvantage.
- Long time required for recharging battery.

3) Application of PVC Pipe Electric Car

- It is useful for domestic and house use.
- Also useful for small scale industry.

V. FUTURE SCOPE

Now, that we have come this far in our project, the next thing that has to be done is to enough testing to be able to accurately evaluate the reliability of our project. We should make sure that the car can handle abuse and inclement weather. Future weather proofing of battery box, motor controller needs to be considered and implemented. We can also use PVC pipe chassis in place of the metal that will reduce weight as well as efficiency will also increase.



Fig. 11: Front View



Fig. 12: Side View

VI. CONCLUSION

The “Electric PVC-Pipe Cart” will be designed for Domestic and short distance travelling. In this system the

energy is given by electrical energy to the motor and the motor converts that energy into mechanical energy and motor is connected to the wheels and cart is run. The system will be handled any operator very easily. Due to low cost and simple design this can be marketed to any of the nation. Cheap, easy, simple, compact device is obtained. This device is mainly fabricated for cheap and for performing the function of the eco-friendly vehicle for the environment.

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REFERENCES

- [1] Ansar Khan*, C.S. Malvi, Department of Mechanical Engineering, Madhav Institute of Technology & Science, Gwalior, Madhya Pradesh, India. “Journal of Polymer & Composites PVC Pipe Designer Furniture”,2018.[1]
- [2] Rishabh Jain, PG student, Vel Tech University, Avadi, Chennai, India. “The Progress Of Electric Vehicle”,2014. [2]
- [3] C .C .Chan University of Hong Kong, Hong Kong, China. “Electric Vehicles”,2012. [3]
- [4] PRAMOD KUMAR GUPTA :-Study of Concrete filled UPVC tubes subjected to axial compression,2011.[4]
- [5] Makris, Konstantinos F, Polyvinyl chloride (PVC) has become one of the dominant construction materials for sewer systems over the past decades, as a result of its reputed merits, 2009. [5]
- [6] Burhanuddin Amravatiwala, Electrical equipment often has at least one motor used to rotator displace an object from its initial position, 2007. [6]