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ELECTRIC AND WIND POWEREDVEHICLE

Design and Development: EWPV

[1]Dr. Deepak Paliwal, [2] Aftab Khan, [3] Dalip Singh Purohit, [4] Digvijay Singh Rao, [5] Kavish Chaplot, [6] Narpat Singh Ranawat

[7] Pansare Nailesh Chandrashekhar , [8] Rahul Shrotriya

[1]Professor, [2,3,4,5,6,7,8] Student
Automobile Engineering Department
Geetanjali Institute of Technical Studies, Udaipur, India

Abstract: Bank of Batteries are the key source of energy to run *an electric powered vehicle. This work focuses on charging the batteries of the vehicle through wind turbine installed at the rear end. The wind direction opposes the flow of vehicle. And at the same time drives the turbine. There is always the flow of wind as long the cars moves with a speed. A wind turbine is mounted on the back of the vehicle in such a way that wind crosses the turbine without much interruption in the energy consumption of batteries which are actually driving the vehicle. In investigation is covered in this paper where the generator is producing electricity from the wind and storesthem in another battery. The vehicle moves with the pre-charged battery and a voltage sensing circuit is placed on one or more batteries of the vehicle to detect the drop in voltage. In such case the reservoir battery that gets charged through wind switches the position with the low voltage battery and continues to run the vehicle while the other battery gets charged. This process can go on until the vehicle comes to stationary. The limitation of short travel range compared to excessive charging time is also addressed. This paper mainly focuses on the design of the wind powered car and to determine the power required for driving the system.*

Index Terms **- Wind Turbine, Generator, Electric Car, Battery, Sustainable Energy**

I. INTRODUCTION

Cars running on fossil fuel do not only contribute to global warming and pollution, but they also have high running and maintenance cost, due to these challenges, alternatives are needed to counter these problems. One way is to adopt a cost effective use of alternative renewable source of energy for land transportation. The use of alternate energies used in automobiles is popular nowadays such as solar powered, hybrid and plug-in hybrid. Electric vehicles are now slowly replacing petroleum vehicles. The pollution caused by the internal combustion vehicles is very high. Here the need for completely sustainable and pollution free energy powered vehicles comes into role. The wind energy is free, sustainable, inexhaustible and abundantly available in the air. Asia is the fastest growing region in terms of wind energy where China being the world's largest wind energy producer with 145,362 MW. A wind turbine is a device that converts kinetic energy of the wind into mechanical energy and into electricity using a generator. Electric cars are becoming popular as an alternate to gasoline vehicles toreduce pollution. An electric motor operates an electric vehicle instead of fuel-generating internal combustion. This is a significant replacement of fuel-powered automobiles to address the problems of increasing pollution, global warming, etc.

As of 2021, the Delhi government will install 500 electric charging points across 100 locations under the EV policy. Not only Delhi, but the Union government announced rebates on taxes two years ago for individuals buying electric vehicles. An electric vehicle (EV) is a vehicle that uses one or more electric motors for propulsion. It can be powered by a collector system, with electricity from extravehicular sources, or it can be powered autonomously by a battery (sometimes charged by solar panels, or by converting fuel to electricity using fuel cells or a generator). EVs include, but are not limited to, road and rail vehicles, surface and underwater vessels, electric aircraft and electric spacecraft. EVs first came into existence in the mid-19th century, when electricity was among the preferred methods for motor vehicle propulsion, providing a level of comfort and ease of operation that could not be achieved by the gasoline cars of the time. Internal combustion engines were the dominant propulsion method for cars and trucks for about 100 years, but electric power remained commonplace in other vehicle types, such as trains and smaller vehicles of all types.

But a drawback of electric cars are their shorter range in travel comparatively. The average travel distance on an electric-powered vehicle is less than of a gasoline vehicle. The range of electrically powered vehicles can be increased by charging the batteries while the vehicle is in motion. This can be achieved by capturing air currents and utilizing it as power. When a vehicle moves there are two types of wind resistance that acts, namely frictional drag and form drag. Frictional drag arises due to viscosity of air and form drag arises due to variation of air pressure in the front and rear side of the vehicle. If a stationary wind turbine is placed near a road, we can absorb energy from it when it rotates due to the

air caused by movement of vehicles beside it. If it is possible to capture those wind streams within the vehicle itself then it can be used to recover some of energy that has been used to overcome the form drag of the vehicle. This system uses a wind turbine installed in the back side of a vehicle that rotates and converts the kinetic energy into electrical energy using a generator. Thisenergy is stored in a separate battery that supports vehicle's battery system. This in turn acts as a reservoir which eventually increases the efficiency of the vehicle.The vehicle has to be charged externally like normal electric car though the wind energy supports it later. The main aim is nothing more than conservation of the planet earth which is under serious danger that is caused by various types of pollution mainly by the increased and over ranging vehicles that causes emissions at relatively larger scale.

Solar cars combine technology typically used in the aerospace, bicycle, alternative energy and automotive industries. The design of solar vehicles always emphasizes energy efficiency to make maximum use of the limited amount of energy they can receive from sunlight. Most solar cars have been built for the purpose of solar car races. However several prototypes of solar cars designed for use on public roads have been designed and built. As of November 2021, no solar cars have reached production, although several are planned to enter production in 2022. There are various solar car competitions around the world that are generally partaken by collegiate and company teams. The most notable competitions is the World Solar Challenge, which is an international competition that takes place in Australia.

Some other competitions include the American Solar Challenge and the United Solar Challenge. Solar cars depend on a solar array that uses photovoltaic cells (PV cells) to convert sunlight into electricity. Unlike solar thermal energy which converts solar energy to heat, PV cells directly convert sunlight into electricity. When sunlight (photons) strike PV cells, they excite electrons and allow them to flow, creating an electric current. PV cells are made of semiconductor materials such as silicon and alloys of indium, gallium and nitrogen. Crystalline silicon is the most common material used and has an efficiency rate of 15-25%. This paper presents the design and development of a vehicle which uses both wind and solar energy in hybrid form as an input source.

II. DESIGN CONSTRUCTION AND WORKING

Design of *blade:* The turbine blades are made out of PVC pipe which has numerous advantages over other materials such as cost and weight. The wind poweredcar has a maximum speed limit of 35 kmph thereforethe selected material is could with stand a linear velocityof 50 kmph which is sufficient and cost effective for thevehicle. Table 1 shows the material property of PVC.

Table 1: material Property of PVC

SL NO.	PROPERTY	VALUE
1	Young's Modulus	3378 MPa
2	Density	1.3 g/cm^2
3	Compressive strength	65 MPa
4	Poisson's Ratio	0.3
5	Ultimate tensile stress	31 MPa

The *turbine* used for the power generation is a 12V DC generator which can produce power upto 24W and generate up to 1A of current.

Construction: The *chassis* is made of metal ss pipe which has qualities like greater axial load strength, durable, less finishing cost and less weight. The material used for the *frame* of the vehicle's body shown in figure 1 is mild steel. Mild possess qualities like ductility, easily weldable, cost effective and strong. Ten pieces of ¾ inch hollow mild steel pipe of 2 meter each, weighing upto 5kg each are used for the vehicle construction.

Steering work: Maruti 800 Steering is used in these vehicle which is compressed on the lathe machine according to the dimensions of the chassis of the vehicle, Shown in the figure 1.

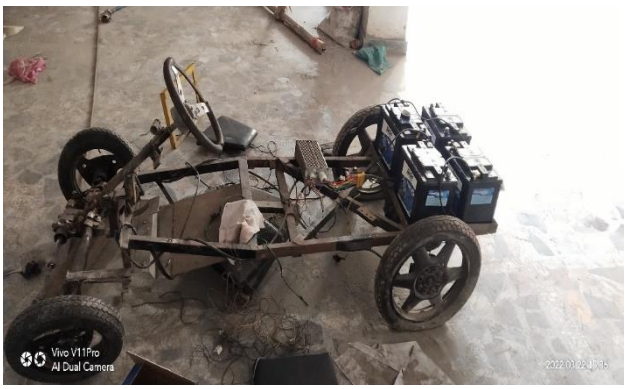

Figure 1: Chassis and Steering work of the vehicle

Bodywork: SS Iron angles are used for the bodywork shown in figure 2. The sheets are cut and bent manually as per the measurements and welded onto the frame. SS metal sheets of 1mm thickness are used for this vehicle. They do not corrode easily and is cheaper than aluminium but heavier in weight. The welding method used for this vehicle is *spot welding*. This is the basic welding method and is easier to operate even for a beginner as they are less dangerous and do not require

any filler metal or flux. As the entire vehicle was manually crafted, spot welding was preferred since the further modification of the vehicle design was easily possible. Hence frame work is shown in figure 3.

Painting work: Antirust primer coating of red oxide is done on the vehicle body and chassis to prevent rust shown in figure 4 and after that coating paitning is done with black metallic colour. Shown in figure 5.

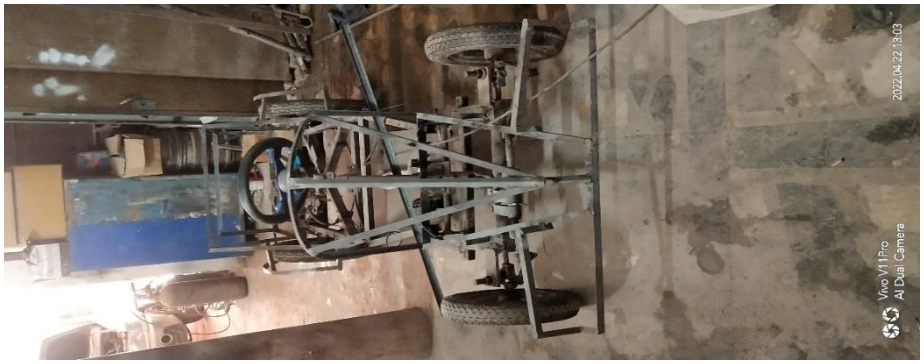

Figure 2: Frame work of the vehicle

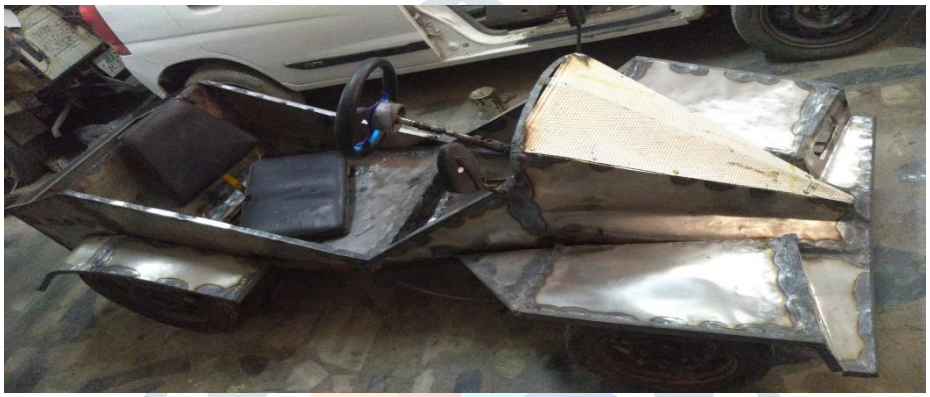

Figure 3: Body work of the vehicle

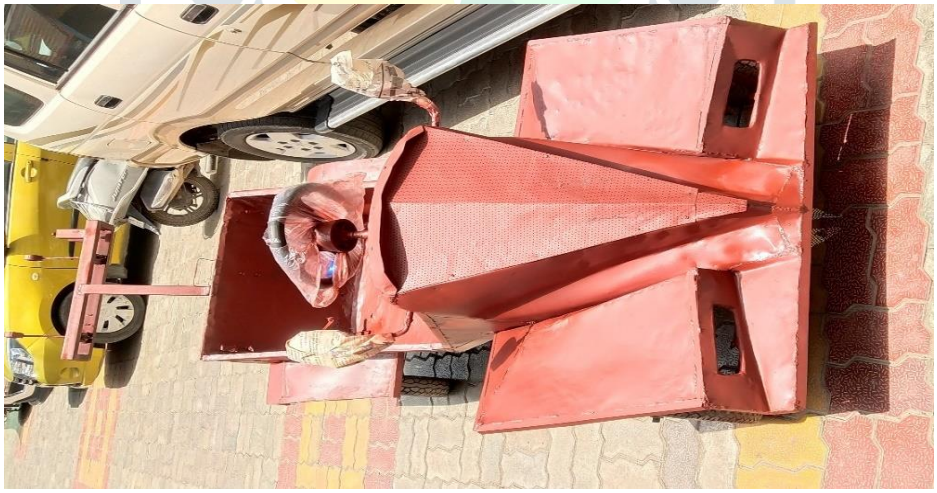

Figure 4: Primer coat applied after grinding

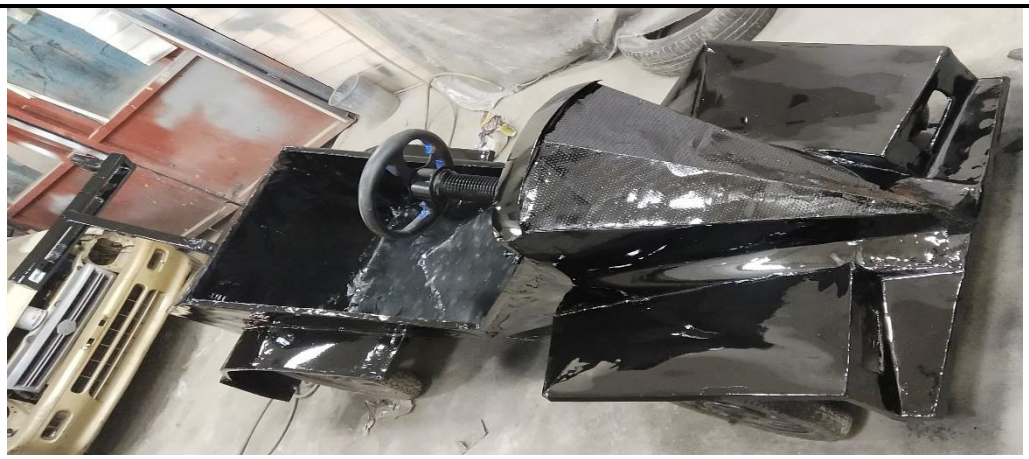

Figure 5: Painting work of the vehicle

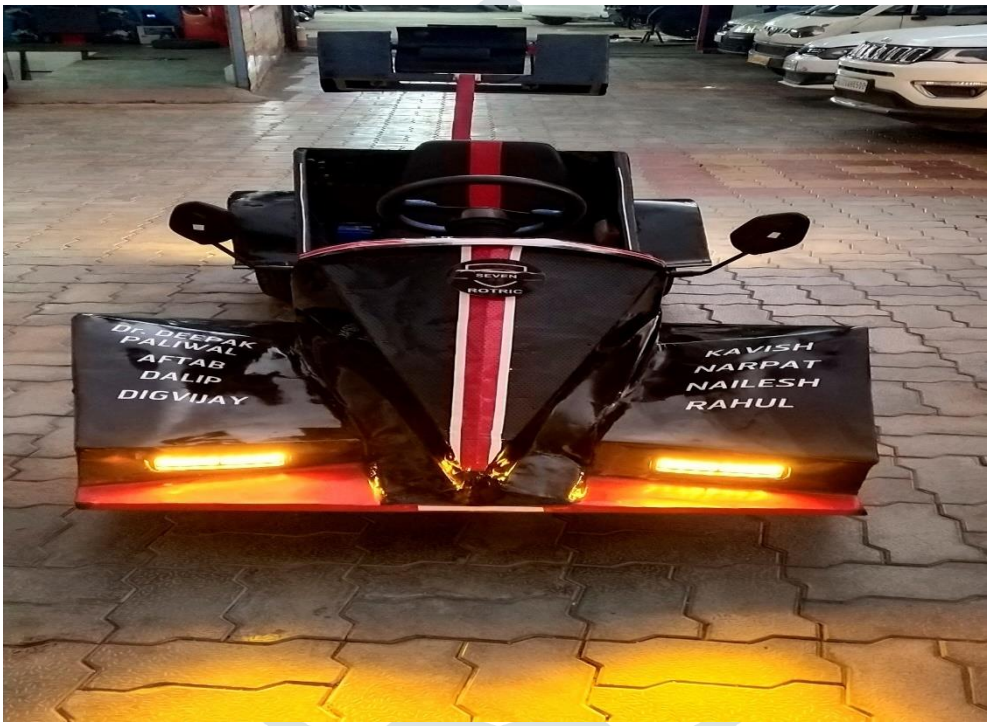

Figure 6: Final Finished Product

Finishing and Painting: The gaps formed after the joining the body sheets are filled using fibre fillers. Steel putty are applied onto the uneven surfaces of the body as well. Grinding process is done later as a finishing work before painting. Grinding is done again after a coat of primer applied and three coats of metallicpaint is sprayed on the vehicle. The vehicle is kept in a heat controlled booth for perfect finishing for a day. A final finishing process of polishing is done after the paint has been dried.

III. WORKING

This electric car consists of six lead-acid batteries of 12 volt and 60Ah each connected in series that gives 48 volt. The batteries are connected to the controller whichis connected to a 48 volt 1 kW DC motor which is again connect to the rear axle of the wheels. The acceleration is electrically controlled by the controller using a pedal. A reservoir battery of the same specification is connected to the vehicle's battery via a switch which can be turned on when the voltage of the vehicle drops below 40 V. This reservoir battery gets charged by the turbine and acts as a backup and boosts the vehicle thus meeting the top speed of the vehicle for a longer time. This reservoir battery also gets recharged by the turbine even when it is in connection. The turbine is connected to a charge controller that charges the battery and maintains the voltage, such that only the battery only gets the charge if the turbine produces sufficient voltage, also cuts the the power transmission to the battery to protect it if the voltage is too high. The vehicle needs to run for at least three hours at top speed in order to recharge the entire batteries with wind energy. In order to keep up that speed the voltage of the batteries

should be maintained, thus the reservoir battery helps in regaining the voltage drop. At top speed the turbine rotates at 500 RPM which generates 12.5 A of current which recharges the entire battery 8-9 hours.

IV. CONCLUSION

The increasing number of vehicles is creating a high demand of fossil fuels which are in fact exhausted highly. Creating a wind powered vehicle will serve as an environment friendly which requires no fossil fuel and utilizing the energies from the atmosphere. Thewind powered vehicle focuses on utilizing the non- conventional energies that are available freely in the nature. There are several methods of harvesting such energies in our daily lives and this method is just a beginning. The method used for this purpose is a wind turbine that captures and stores the energy in a battery that helps to increase the runtime of the vehicle also helps in charging the vehicle as well. Advantages such as cost effective, eco-friendly and free energy conservation can be added. The current weight of the vehicle is a concern which limits the speed of the vehicle. The vehicle can be used in various fields wherethe fossil fuel is expensive and highly polluted cities where they struggle in reducing carbon footprint. Futuremay seem to have electric cars that can charge on the run and wind power method will be one among them. From the graphs, Speed of the blade vs. Power we can conclude that the power generated from the turbine increases with the increase in the speed of the blade. Speed of the blade vs. Voltage, it shows that the voltageproduced by the turbine increases as increase in the speed of the blade. Speed of the blade vs. Current, it shows that the current produced by the turbine increaseswith the increase in speed of the blade. Linear velocity vs. Speed of the blade, it concludes that the speed of theblade increases with the linear velocity of the vehicle. Some of the merits this vehicle offers like it uses sustainable energy as fuel since it does not pollute the environment, Conservation of energy which is free and abundant and utilizing it in the daily lives, Cheap of cost effective compared to other electric cars and Energy can be generated at any time of the day unlike solar vehicles.

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