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E-Vehicle Battery Recharging

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Abstract

Electric Vehicle is one of the prominent ways to curb the greenhouse effect in today's scenario. Our prime idea is to use small wind turbines, which will be mounted in front of the E-vehicle so that the vehicle keeps charging while it's in motion. The small wind turbine is mounted in front of the vehicle because the velocity of air around it is maximum As long as the vehicle is in motion, the moving air will propel the turbine, and thus power is generated which in turn charge the battery. Hence our idea is capable of reducing the discharge rate and gives extra ride distance. The alternate charging source for the battery is only depended upon the wind which is a renewable energy.

Keywords: Turbine, Electric Vehicle

1. Introduction

During the last two decades, the effect of greenhouse gases has led to major impact on the environment due to petroleum-based transportation infrastructure. Thus, the world is gradually moving towards Electric Vehicle rather conventional internal combustion vehicle. Because electric motors are responsive, better torque and zero emission (Eco-friendly).

As of now, the primary source of power for E-Vehicle is only the battery. Hence the capacity of the battery is also high in order to give long ride distance. Higher the battery capacity, higher the time taken to charge one full cycle. On average an electric vehicle takes around 3-4.5 hours to charge the battery. The major source of electricity comes from coal, nuclear energy, natural gas and renewable sources. Charging the EV with renewable energy such as solar or wind energy will further bring down the emission.

2. Proposed System

Generally, the wind energy is utilized by setting up large windmill farms to generate power for charging stations. But practically this sounds impossible. Because huge installation cost, large area is required and most importantly for each charging station creating windmill plant is quite impossible since wind differs with respect to geographical area. So, we have implemented the alternative idea by using small wind turbines on EV to recharge the battery since it cost effective and it can be used round the clock unless the vehicle comes to rest.

3 Operation

Wind turbine of tiny size is attached in front of the electric vehicle since the flow of air is found to be maximum at front. The dynamo uses the kinetic energy of the air to rotate the blades which results in conversion of mechanical to electrical energy.

As long as the vehicle is in motion, it moves or rotates the blades. When the blade rotates the shaft connecting to the generator also rotates which induces the generator to generate power. The generated power is then connected to the main battery of EV to charge them continuously during motion.

4. Hardware Architecture

4.1. The following are the components used for modelling the proposed system:

REQUIRED COMPONENTS	SPECIFICATIONS
BATTERY	12 V, 1.3 Ah
Motor	12 V, 500 RPM
Dynamo	12 V, 1000 RPM

Fig 1. Rechargeable Battery

Fig.2. Dynamo

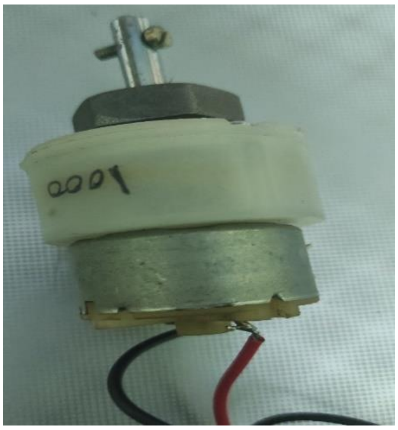
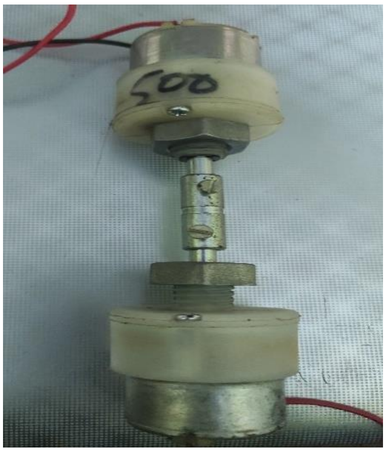
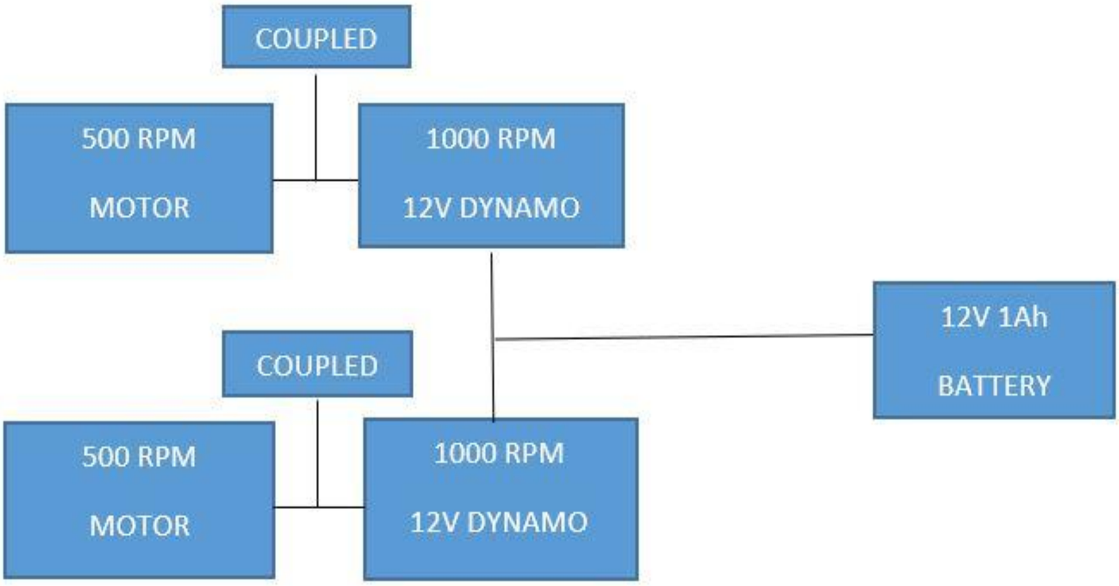


Fig 3. Motor



4.2.. Block Diagram:



5..Readings

Fig.4. Voltage Generated At 500 RPM per hour

Fig.5. Current Produced At 500 RPM per hour

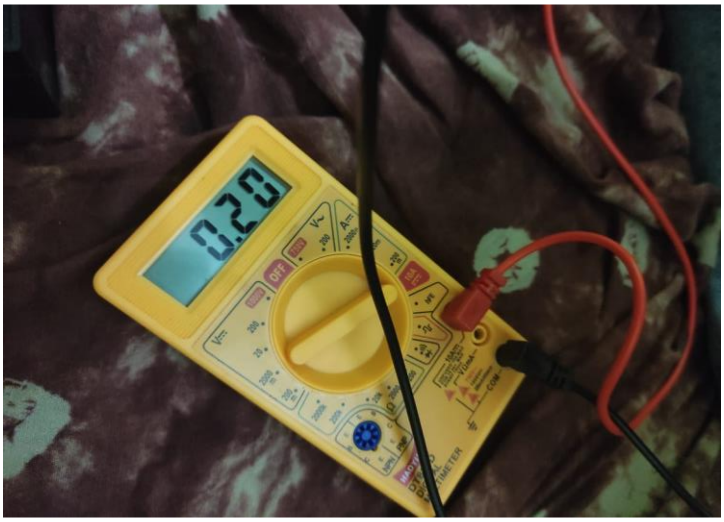


Fig.6. Voltage Generated At 1000 RPM per hour

6.. Desgin Specifications

Power=15.6 Watts

P = V * I

I = P / V

I = (15.6) / (12)

I = 1.3 Amps

Battery Capacity = Current * Time (in hrs)

= 1.3 * 1

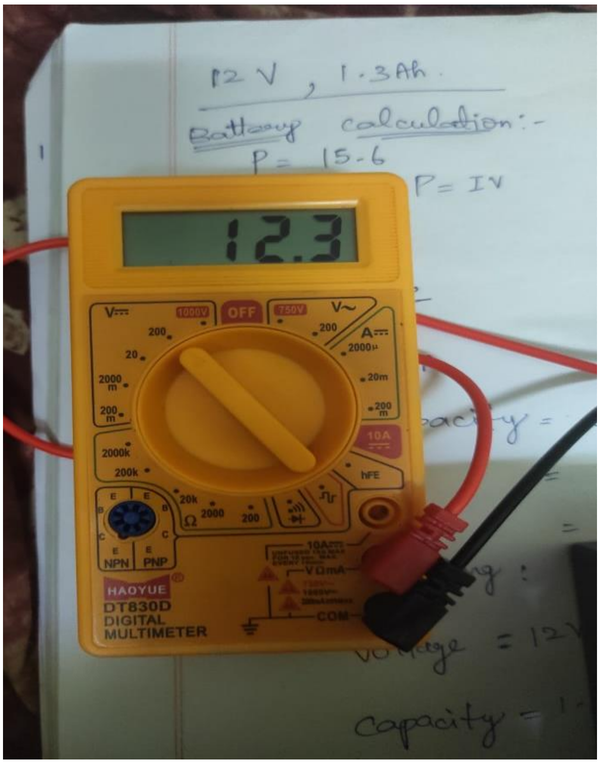
= 1.3 Ah

Batter Rating:

Voltage = 12V

Capacity = 1.3Ah

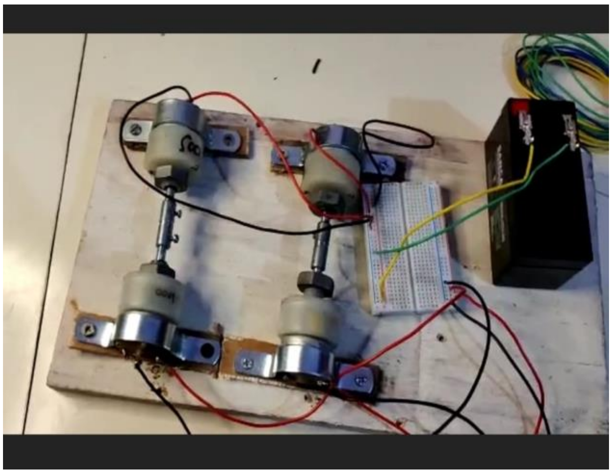
Fig.7. Battery Voltage



For a 12V battery, 1.3A of current is required to charge the battery completely in 1 hour.From, a 12 V dynamo generator at 1000 RPM speed,0.4 A current is produced. So, in order to complete one full charge cycle 2 hours 15 minutes of time is required.Hence, if we connect the 2 or more generator parallelly, the net current is equal to the product of 0.4 and number of generators used.For instance, if we connect two dynamos in parallel, then the output current will be 0.8 Amps. As a result, the battery takes 1 hour 0.75 minutes to charge from 0 to 100 %.Therefore, from the above statement it is clear that number of generators in parallel used is inversely proportional to time taken to charge the battery for a full cycle.

The below Fig.8. is the final prototype of the idea which we implemented.

Fig.8. The Final Prototype



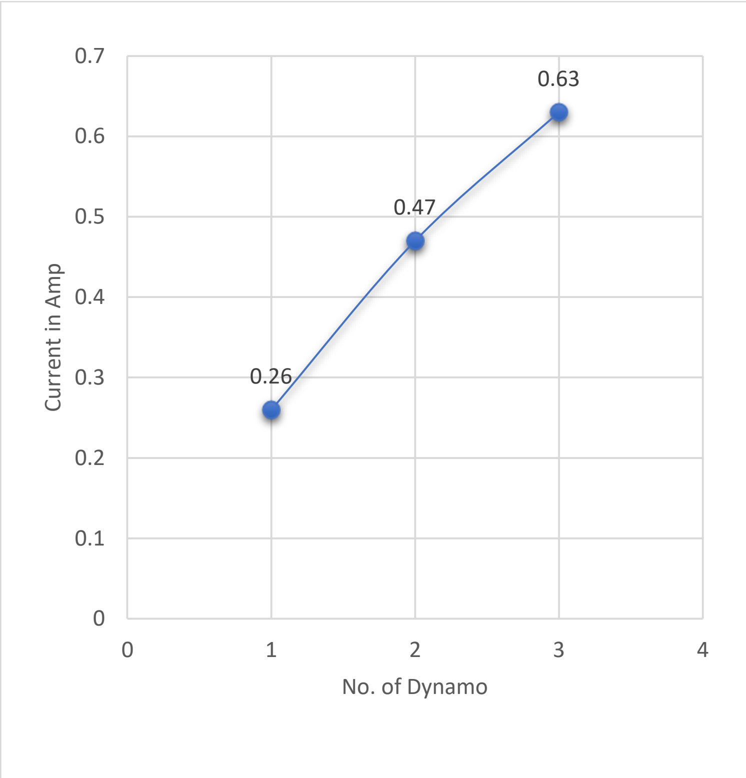
7. Results & Discussions

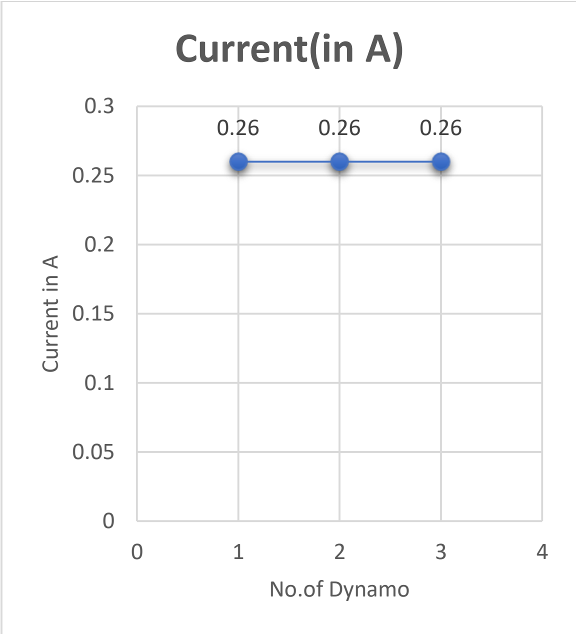
From a single dynamo we will be able to produce 3V of voltage and 300mA of current. Simultaneously we can connect "n" number of dynamos in parallel or series depending upon demand for voltage or current.

The following table explains clearly the type of connection and how it is used to increase the output based on the demand of the battery.

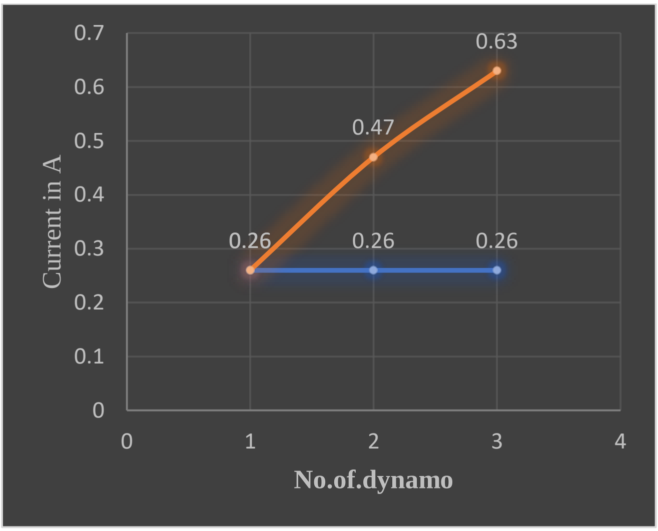
No. of dynamos used in an EV(Series)	Voltage (in V)	Current (in A)
1	3.5 V	0.26A
2	7 V	0.26A
3	10.5 V	0.26A

No. of dynamos used in an EV(Parallel)	Voltage (in V)	Current (in mA)
1	3.5 V	0.26A
2	3.5 V	0.47A
3	3.5 V	0.63A





Comparison of Series & Parallel Connection



8.Benefits

- The idea which we have inculcated iscompletely relied on only wind energy which is a renewable energy.
- This system does not involve any harmful emissions to the environment. Thus, it is considered to eco-friendly.
- The model can work round the clock irrespective of place, temperature and other climatic conditions unless the EV stops the motion.
- It also controls the discharging rate of the battery of the EV to some extent since battery is continuously getting charged.
- It also reduces the money spent for charging the battery in an EV.
- The user need not to wait for long time to charge their battery since continuous power is supplied to the battery whenever an EV is in motion.

9. Existing System

So far there are two existing system to charge the battery while the electric vehicle is in motion. They are:
1) Rooftop Solar Panel
2) Rooftop Wind Turbine
But both the system has some disadvantages compared to the proposed system.

1) **Rooftop Solar Panel:** In this model, the large solar panels are placed on the rooftop of the electric vehicle such that solar is converted into electric energy to recharge the battery. But solar panel add extra cost to the capital cost for manufacturing the vehicle. Also, solar energy is not available round the clock and thus the efficiency fluctuates based on the availability. Hence constant power is not delivered to the battery which directly affects the battery health. The efficiency of solar panel decreases under the influence of dust, smog and water. Keeping these cons into consideration we have developed a better system.

2)**Rooftop Wind Turbine:** In this model, a large wind turbine is mounted on the rooftop of the electric vehicle to harness wind energy and generate electric power to recharge the battery. But the biggest disadvantage is that it adds extra weight to the vehicle. As a result, the torque of the vehicle decreases and in presence of high wind speed, drag comes into play. Hence the vehicle performance decreases gradually compared to the promised efficiency by the manufacturers. The picture is given below for better understanding.

So compared to the above existing systems, we believe that our prototype can bring down the challenges faced above.

10. Conclusion

In the recent trend of E-Vehicle, charging their battery is the main problem because either it takes long time to charge (3-4 hrs) at home or due to lack of charging stations at frequent distance. Hence, our idea will be very useful in charging the EV because the concept depends on only one source, i.e., wind which is free and renewable in nature. Therefore, it also promotes sustainable development for better future generation..

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