

Solar and Wind Power Chargeable Vehicles

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Abstract : The introduction of electric vehicles have changed the future of automotive industry and transport with advantageous over internal combustion vehicles ,electrical vehicles uses electricity instead of fossil fuels, the vehicle powered by electricity from battery can be charged through solar and wind power, solar and wind powers are clean and renewable energy sources ,this system has two battery packs uses both these sources to charge the vehicle while on drive and saves time in charging an vehicle, two battery packs are realized using relay switching ,one will be used to drive the vehicle and another for charging while on driving and can be switched.

IndexTerms – Automotive, Internal Combustion, Renewable, Relay switching, Electric Vehicle.

I. INTRODUCTION

The electric car is peculiarly developed so that the energy limitation can be easily prevail over by using the hybrid vehicle technology [1]. As the electric vehicles that use batteries are beneficial to the society and bounteous for the environment. In order to overcome the energy limitations, we have installed wind turbine with solar panel and that helps in reducing Carbon Dioxide Emissions, the most effective way to reduce carbon dioxide emissions into the environment is to reduced use of fossil fuel consumption [2]. Many approaches were introduced to reduce CO₂ emissions from energy are applying to homes, businesses, industry and transportation. Solar energy is the radiating light and heat from the Sun extracted using ever evolving technologies such as solar architecture. The solar and wind energies are abundantly available throughout the world making them the highly available electricity generating sources. Wind power is generated by air flowing through the wind turbines to mechanically rotate the shafts power generators for electricity [3]. Wind power, is an alternative to fossil fuel burning, is abundant and renewable, globally distributed, clean, does not produce green house gases, and uses less land [4].

1.1 Reducing emissions from vehicles

All electric vehicles including hybrid electric vehicles, plug in hybrid vehicles produce less pollutants than the conventional internal combustion engine vehicles, When measuring emissions from wheel to wheel, the electricity source is important for the PHEVs and EVs [5]. They are powered from the external batteries. There are emissions associated with making of electricity in the world. EVs and PHEVs running on electric power have less tailpipe emissions, but from burning coal and power from nuclear plants can generate emissions, such as the power plants and power stations. Globally in areas that use relatively low-polluting energy sources for electricity generation, PHEVs and EVs typically have lower emissions than similar conventional vehicles running on petrol and diesel. In countries that mostly generate power from coal, PEVs may not provide a strong emissions benefit [6].

1.2. Solar power

Solar technologies generate electricity by converting sunlight to electric power using photovoltaic panels or through mirrors that concentrate the solar radiation. This energy is used to generate electric power and can be stored in batteries. Solar radiation is light also called as electromagnetic radiation that emitted by the sun. Every place on Earth is illuminated by sunlight, the amount of solar radiation that reaches the Earth's surface varies with locality. Solar technologies like Photovoltaic cells capture this radiation and convert it into different forms of energies that can used for power generation. Solar cars depend upon Photovoltaic cells to convert sunlight into electricity to drive electric motored vehicles. The solar thermal energy converts solar energy to heat, solar panel cells convert the sunlight into electricity [7]. Here a 12v 300mah solar panel is used to charge a 12v 1.3 ah battery

Charge time = capacity of battery /current generated from solar panels

Charge time=1.3/0.3 along with losses

Charge time = 4.3 ~ 4.5 hours in real time

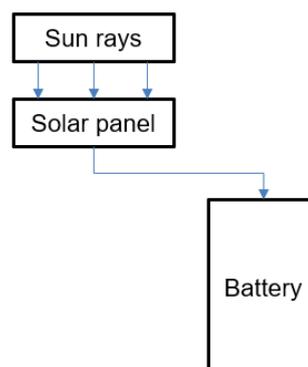


Fig. 1. Power from solar panel.

1.3. Wind power

The kinetic energy from air in linear motion is used to generate electricity. This is converted into electrical energy using wind turbines. Wind hits a turbine blade, causing them to rotate and turn the shaft connected to them. That converts the kinetic energy to rotational energy, by moving the shaft which is connected to the generator, and thereby generating electrical energy using electromagnetism [8].

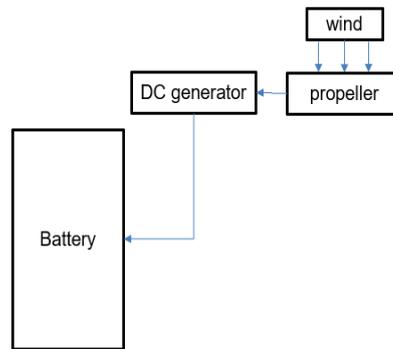


Fig. 2. Power from DC generator.

The amount of electricity that can be produced from wind depends upon the length of the blades and size of the turbine. The output power is proportional to the dimensions of rotor and to the cube of the wind speed. Theoretically, when wind speed doubles, wind power potential increases by a factor of eight [9]. Electrification of transportation system can be a leap that the renewable energies needed for the generation of electricity to reduce and overcome the disadvantages of not being manageable and not being able to guarantee supply. Wind energy is a technology with the greatest potential in the short to medium term, the batteries that operated in the vehicles can be recharged when there is electricity from wind power [10].

The DC generator ratings are 0.4w with ability to generate 12v – 24v based on the RPM of the shaft connected to the propeller. The induced voltage E_a is proportional to the speed & armature current whereas the torque T of a generator is directly proportional to the square of armature current & it is given by: [11].

$$E_a = k_f \Phi \omega I_a$$

$$T = k_f \Phi I_a^2$$

Where,

- K_f is a constant depends on machine construction
- Φ is the magnetic flux
- ω is the angular speed
 $\omega = (2\pi N)/60$

Where N is the speed in RPM

DC generator- 12-24v ,0.4ah

Battery -12v ,1.3ah

Charge time = 1.3/0.4

Considering losses

Charge time = 3.5 hours

1.4. Electric vehicle

Electric vehicles use electricity as the primary fuel and to improve the efficiency of conventional vehicles. EVs include all-electric vehicles, also referred to as battery electric vehicles, and plug-in hybrid electric vehicles. In colloquial references, these vehicles are called electric cars [12].

II. METHODOLOGY

In proposed system we are using natural and ecofriendly resources. We are using Arduino, solar panel, 12v battery, DC motor, propeller, robot, Bluetooth module. Here we are using solar panel and DC motor attached with propeller for wind energy and we will connect it to battery. Here battery will store power that is created from solar and wind. Here we are using batteries to store the energy from the wind and solar [13].

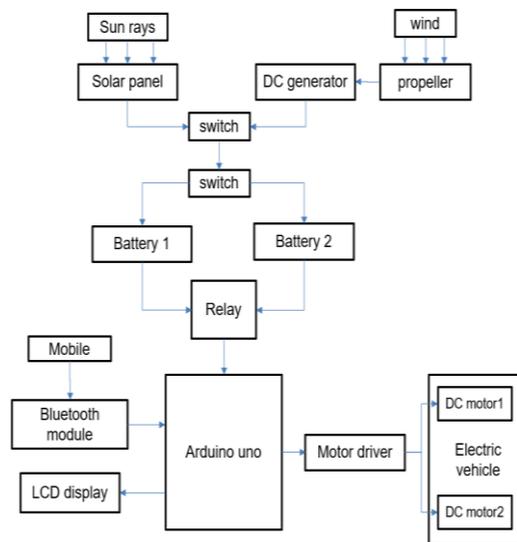


Fig. 3. Proposed block diagram.

This process will be continuously on. And after that this battery supply is given to Arduino, Arduino will take power from battery. We are using Bluetooth module to control the robot. We can control pollution and power by using this system [14]. both the batteries are connected over a relay system, the solar panels and a dc motor accompanied with propeller are connected into the relay system, first we can charge both the batteries using external power supply and the first battery is used to drive the vehicle and after the first battery is drained the charge power is indicated on the lcd display, then we can either switch manually or automatically [15], the drive channel is switched to second battery pack using relay switching and the second battery pack is now in use, the drained battery is the connected to the charge system and this battery will be charged on the way using solar and wind power, the output from propeller system is depended on the speed of the vehicle and the solar power on intensity of sun light [16]. after the second battery has been drained the first battery might be charged to some extent and the first battery is now switched to drive the vehicle and the second battery is connected to the charge system and this process can be continuously done and the range of the vehicle can be increased with single charge from external supply [17].

III. WORKING

Electricity generation systems using wind power that are in use till now are dependent on the force of the wind and wind direction. But wind isn't available in all locations and all time throughout the time. Therefore, there is a need of a systems for generating electricity from wind that is induced by moving the vehicles with sufficient force of wind [18]. Also, solar powered electric vehicle are there. Therefore the need for the invention of a renewable energy source as an main source for fuel vehicle [19], this system is being developed such that we can charge our vehicle on the way while we are driving, here we are using two sets of battery packs one is being used whole driving and other packs is charged while driving [20], we can charge both packs, we can use one pack for initial range and later we can switch to the other battery pack using a relay and the same relay is used to switch the discharged battery pack to charge it while driving and later after the second pack is discharged we can switch to the first pack using the relay, and we can use this method to increase the range of the vehicle. Therefore, this project provides a solution to the problem for generating electricity in environmental friendly manner.

3.1 Switching between solar panel and DC generator

There will be a potential difference between the solar panel and dynamo as the solar power depends upon the sunlight intensity and the voltage generated from the dc generator depends on the wind speed that rotates the propeller i.e., rpm of the DC generator so there is a voltage difference because the electricity varies from solar panel based on time and from dynamo based on the speed of vehicle so we can switch in between solar power and DC generator depend on our preference this power will be sent to the battery packs that is low voltage and the battery will be charged when the voltage generated from the solar panel or DC generator is above the battery voltage that is if the voltage in battery is 4v which is less than the power needed to power the Arduino uno which is 5v then if that battery pack needs to get charged then the voltage from power generators must be greater than 5v, while the battery is getting charged its voltage will increase so for efficient charging the voltage from power generators must be at least 12v.

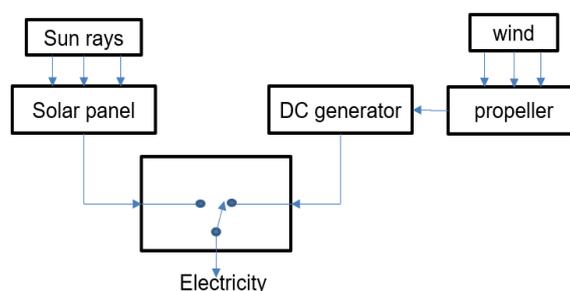


Fig. 4. Switching between solar panel and DC generator.

3.2 Switching to charge batteries

The battery pack that is low on charge needs to be charged, a switch is used to select the battery packs, this is physically realised using a switch and can be controlled manually to select the battery packs and the other battery pack will be used for powering the microcontroller.

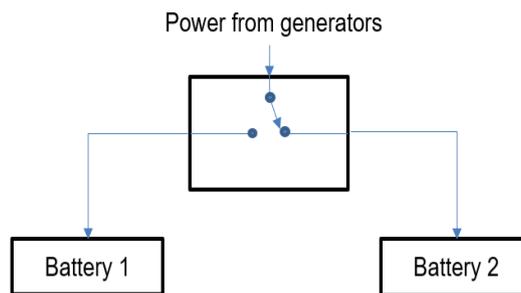


Fig. 5. Switching to charge batteries.

3.3 Switching between the batteries to power the microcontroller

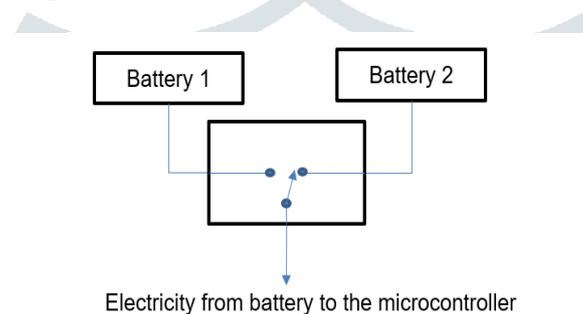


Fig. 6. Switching between batteries to microcontroller.

A relay is used to switch between batteries to power the microcontroller later to the other modules like LCD, Bluetooth and DC motors in the electric vehicle. The relay automatically switches the battery packs to power the components when a battery falls below 5v of power the relay automatically switches to second battery and the drained battery will be charged using charging mechanism either by power generators or using external power supply.

IV. EXPERIMENT RESULTS

4.1 Solar panel

Solar panel connected to a battery is placed under sunlight for a whole day and the voltages at different times were recorded using a multimeter and the battery status is also noted

Table 4.1. Solar panel- voltage vs time

Time	Voltage(V)	Battery status
10:00 am	5.06	Charging
10:30 am	5.76	Charging
10:45 am	6.5	Charging
11:15 am	7.23	Charging
12:45 am	8.57	Charging
12:30 pm	9.07	Charging
01:15 pm	10.23	Charging
01:45 pm	11.1	Charging
02:30 pm	12.6	Battery full

4.2 DC generator

A DC generator connected with a propeller is connected to the battery and the propeller is rotated using a fan that can rotate with a speed of 1000 – 4500 RPM. The electricity generated from the DC generator is depended upon the RPM of the shaft that is connected by propeller, wind flowing in a direction is in linear and the air when faced by a wind turbine this linear force is converted to rotational force this force is used to rotate the shaft of the generator which induced electricity in the generator this voltage is measured at the terminals of the generator using a multimeter for different speeds. Here the wind generator circuit is placed on a vehicle and while moving at certain speeds the voltage is noted.

The voltage is recorded using a multimeter we can find the rpm off the shaft for certain voltages using the formula The emf of the DC generator is given by the equation:

Where.

$$E_g = \frac{P\phi ZN}{60A}$$

E is induced EMF in any parallel lane within the armature.

E_g is generated EMF in one of the parallel lanes

Z is total number of armature conductor

P is number of poles in the generator

A is number of parallel lanes within the armature

N is rotations of armature in RPM

N/60 is number of turns per second

The Time for one turn can be taken as $dt=60/N$ sec

Table 4 2. DC generator- RPM vs voltage

RPM	Voltage (v)
0	0
1000	3.05
2433	7.36
3900	11.72
4533	13.6

IV. CONCLUSION

This paper explains how the solar and wind power can be effectively utilized in charging an electric vehicle. The prototype made is in working condition , power is generated from solar panel and DC generator ,the battery packs can be charged by an external power supply ,the solar and wind power are renewable and clean energy sources so the pollution from generating electricity can be decreased if this system can be realized in electric vehicles ,the battery packs are spitted in two so the cost of batteries will remain same, the either solar or wind power will be used for charging since there is a potential difference generated between them ,the power generated is depended upon the light intensity and speed of the vehicle driving. There is a huge potential in using renewable energy sources in automotive industry.

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