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Wireless Charging for Electric Vehicle using Solar PV-Wind System

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ABSTRACT*:* In the fast changing world the form of fuel for cars is also changing from petrol/diesel to battery. In the Electric cars and bikes there is a major drawback that it could not travel more than few hundred miles. Once the battery capacity increases then the weight and size increases, thus it is not possible. So, the development of charging stations along the roadside should be increased. This paper gives an experimental setup to develop wireless charging station using solar and wind system. For this two separate batteries are used, and also main supply. After comparing the two batteries charge using arduino, through voltage sensor the arduino will decide which battery will give charge for upcoming electric vehicle through wireless charger.

KEYWORDS: Solar Panel; Windmill; Wireless Charging Station; Arduino Uno.

I.INTRODUCTION

The wireless charging of electric vehicles is based on the inductive power transfer between two mutually coupled coils, one is “primary” connected to charging station with solar, wind and main supply and the other “secondary” connected to the battery of E-vehicle. The advantages provided by the wireless charging are in terms of safety and comfort, as the driver can avoid danger by using power cord and he needs to park the vehicle without the need of plug-in operation to start charging the battery. The WPT can also occur in reverse direction, so that the power could again be send from the vehicle battery to the grid in times of need. Thus the wireless power transfer also fit for bi-directional power flow [1],[2],[3],[4].This paper mainly keen on the concepts of Wirelessly charging the electric vehicle[5],[6]. The wired charging can be mainly four types and all are explained in[7],[8]. The charging can be done through pv-wind grid connected system. The use of solar and wind is pollution free and eco friendly in use. However the battery charging need to be taken care and an algorithm is also developed for pv-wind system.The various configurations for hybrid solar wind systems has been presented . Models of a horizontal axis wind turbine and a PV array and their MPPT power tracking controllers and adaptive voltage controllers and supervisory controller and Standalone hybrid pv-wind system is studied[9],[10].The charging stations for electric vehicle using solar-pv is given[11], [12].

II. WIRELESS CHARGING AND PV-WIND

Electric vehicle charging station, is an element in an infrastructure that supplies electric energy for the recharging of electric vehicles, such as plug-in electric vehicles, including electric cars, neighborhood electric vehicles and plug-in hybrids. At home or work, most electric vehicles will charge their batteries. Others either require or can use a charging station in roadways. In these places the use of Wireless charging stations running with the renewable energy sources will ensure their safety and easier way for charging.

The use of solar and wind energy will be pollution free and eco-friendly The electric vehicles are developing as there is a decrease in fossil fuel, so the dependency for electricity from fossil fuel and non renewable resources will not going to make changes. Thus the development of renewable energy will do the needy and solar and wind will be available all time.And also the use of solar and wind energy will be pollution free and eco-friendly.

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In this an arduino board is used. And this arduino will check the battery voltages. As the arduino cannot hold 12 volts, the voltage from battery is checked through voltage sensors and then feed into the arduino. By using this measurements we set up the voltage level drop of the batteries of solar panel and windmill upto 8 volts. After that volage level no battery is allowed to charge the upcoming units(i.e. E-cars). This is continuous process and it check periodically. By using two separate batteries it is easier that different ratings of wind mill and solar panel can also be used. A wireless charger is made so that the battery can be charged quicker and easier. In the wireless charging technique two coils will be used as primary and secondary, the secondary coil will receive the power from the primary.

III. SYSTEM SETUP

A. BLOCK DIAGRAM

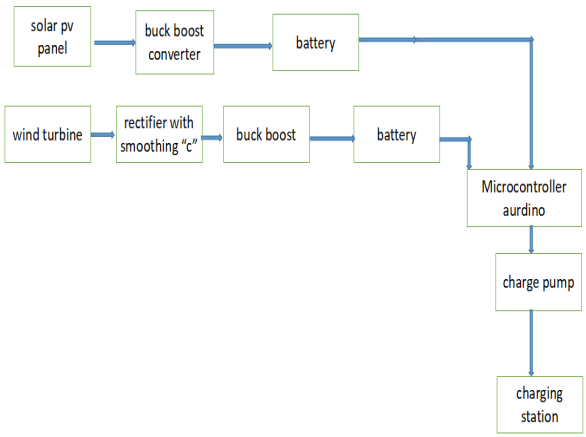

Fig 1 Block Diagram of the system

In this fig.1 explains the solar and wind charging system with wireless charging station schemes. Buck-Boost converter smoothens the voltage from the solar panel and the energy is stored in the battery banks. A parallel scheme for wind turbine is seen with voltage regulating circuitry to store the battery. The two voltages are compared using Arduino board which pumps the charge into the sink. Figure 1a shows the coupling link present in the e-vehicle which is fed with the energy further to be rectified and stored in the battery.

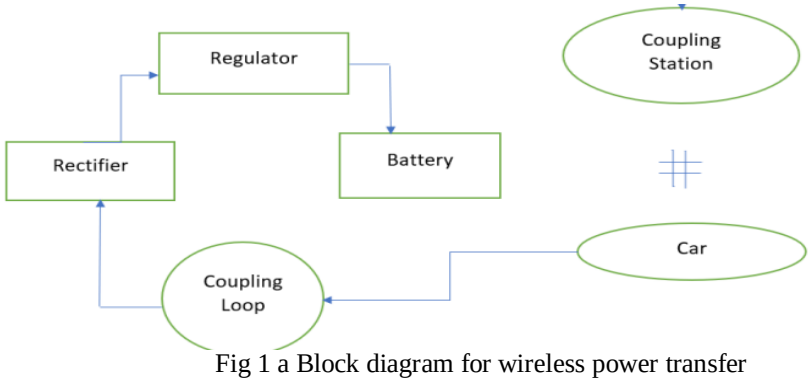

Fig 1 a Block diagram for wireless power transfer

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B. CIRCUIT DIAGRAM

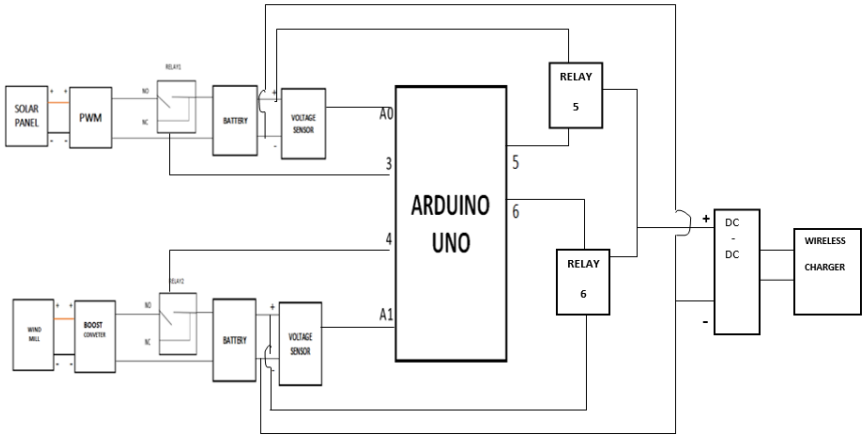

Fig 2 Circuit Diagram.

In this the arduino plays a major role in controlling the battery charging system. The batteries of solar panel and windmill are continuously checked with arduino using voltage sensors and their signals are fed into arduino pins A0 and A1 respectively. By the use of voltage sensor the voltage values are continuously received to the arduino port. Thus the arduino pins 3 and 4 is used to control the relays on solar and windmill side. These relays are used to control the charging of the batteries by tripping it off when a voltage of 16 V or more is reached. Pin 5 and 6 of arduino is used to control the relays 5 and 6. When a car comes to the charging station the arduino senses it and it switches off the relays 3 and 4. Then the arduino checks the battery level of both solar panel and windmill and then suitably turns on the relay 5 or 6 based on the which battery has the highest voltage level. This voltage will be delivered through a dc-dc converter to the charging vehicle.

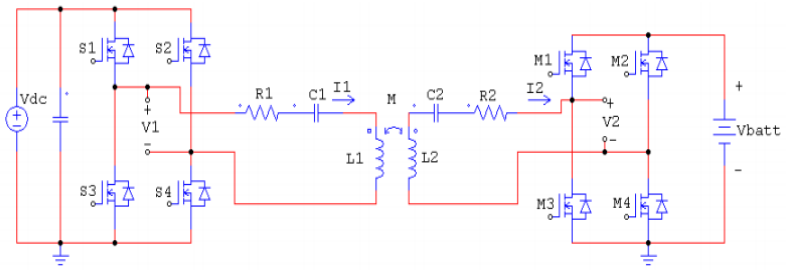

Fig 2 a wireless charging circuit diagram.

This fig 2.a is the Wireless charger setup. In this the Vdc part will be connected to the output that is 12 volt for our miniature setup.The inductive coupling model consisting L1, L2 and M, being the primary and secondary self-inductances and the mutual inductance respectively. C1 and C2 model the primary and secondary compensation capacitors,useful for maximizing the power factor and optimizing the power transfer.

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IV. COMPONENTS AND SIMULATIONS

A.SOLAR PANEL

A 10 W Solar panel with open circuit voltage rated at 21 V is employed in the proposed system. The short circuit current for the panel is 0.833 A.

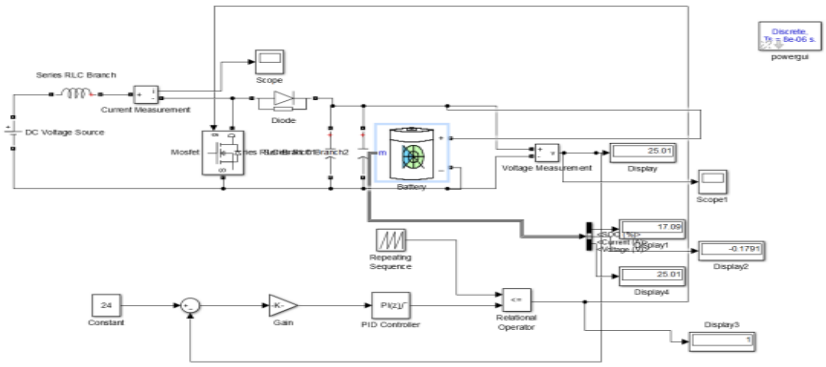

Fig 3 simulation of closed loop boost converter.

In this setup a boost converter is designed by rising it to 24volt from 12volt to charge a 24volt battery. And the boost converter is made as closed loop circuit, hence they work in similar way to pwm controller.

B. WINDMILL:

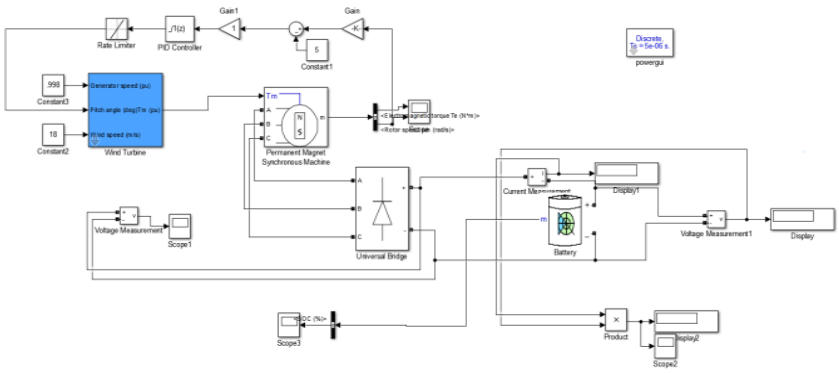

Fig 4simulation of windmill

In wind system for matlab we used permanent magnet synchronous machine and a wind turbine coupled to it. Then inorder to store it in a battery a universal bridge is used. Then they are converted into a dc source and stored in a battery. To control the pitch angle, a pitch angle controller is used.
In real time we couple a 6volt 3watt dynamo and used it to charge the battery from wind turbine.

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Fig 5 Two different types wind turbine.

It is noted that even below 4m/s the larger blade rotates but the smaller blade does not. But during a continuous high flow of air smaller blades performance is good compared to larger blades. However, as the wind speed not be constant ever the larger area blades are preferred even the smaller blades can give high voltage for same wind speed.

Wind speed	Average voltage produced	
	Small blade	Large blade
4-6m/s	10.20	3.80
6-12m/s	13.40	4.20
12-16m/s	16.30	4.80

C. ARDUINO UNO:

Arduino is an single board microcontroller meant to make application more accessible which are interactive objects and its surroundings. The hardware features with an open-source hardware board designed around an 8-bit Atmel AVRmicrocontroller or 32 bit Atmel arm.Current models consists a USB interface,6 -analog input pins and 14 digital I/Opins that allows that the user to attach various extension boards.Our arduino board is connected acrossbattery and 4-module relay.The coding is dumped in microcontroller for processing the required function.The process of arduino board is to sensethe voltage value in the battery through a voltage sensor.

In this the algorithm is programmed in such a way that it will first check the solar panel battery. And then if the solar panel battery voltage is below 8v it will switch over to wind turbine battery. Similarly in wind turbine also it will check with volt if the volt above 8 v it will continue it's operation; if it is low then switch over to solar battery. If both the battery voltage is below 8v then it will not switch on. Also they will check battery voltage continuously once the battery attains full charge then arduino will open the relay and stop the flow of charging current to the battery.

D. RELAY:

The relay has three pins NO, COM and NC. In this 4 relays are mainly used two at the solar and windmill side to prevent the battery from over charging and then two for giving supply to the wireless charger.

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V. RESULT AND CONCLUSION

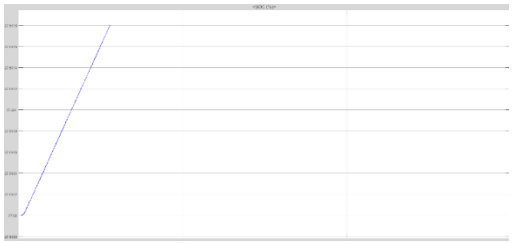

Fig 7Solar panel charging curve

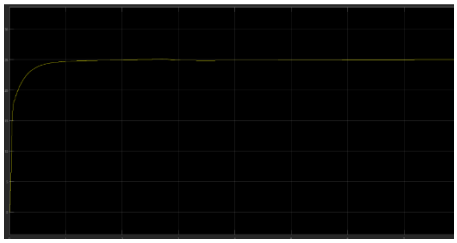

Fig 7 aBoost converter output

Fig 7 and Fig7.a shows the solar panel charging curve and boost converter output curve. Hence the boost converter is closed loop circuit so even the values of input side changes it will maintain a constant output value.

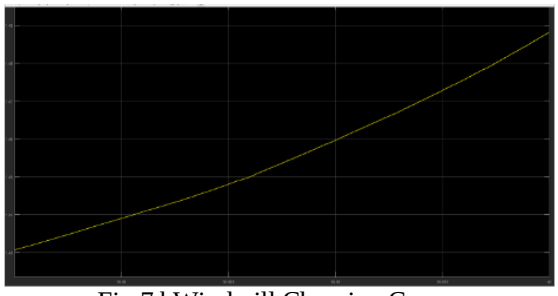

Fig 7 bWindmill Charging Curve.

Both the wind and solar simulation shows that the batery will increase linearly. But the wind utilized energy will be slow compared to that of solar powered battery charging curve.

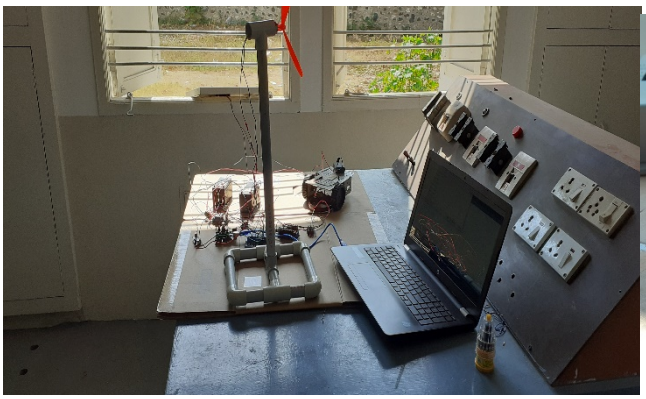

Fig 8 Implemented prototype

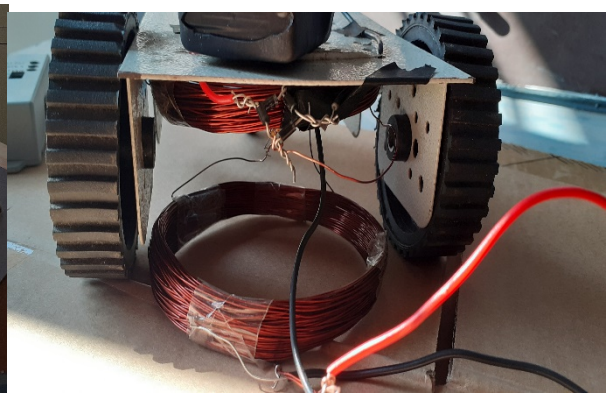

Fig 8 a Attaching primary and secondary coils

The fig 8 and fig 8.b represents the overall setup for the prototype and in this a windmill with dynamo is made and a solar panel is also attched and for giving supply to aurdino the laptop is used. During implementation a 12 volt dc converer can be used. We transfer a 12 volts from the transmitter to reciever. In the reciever side a bride rectifier is used inorder to convert it into a dcand then it is stored in a battery. Fig 8.a shows the arrangement of the primary and secondary coils. The secondary coil is nothing but the reciever coil.

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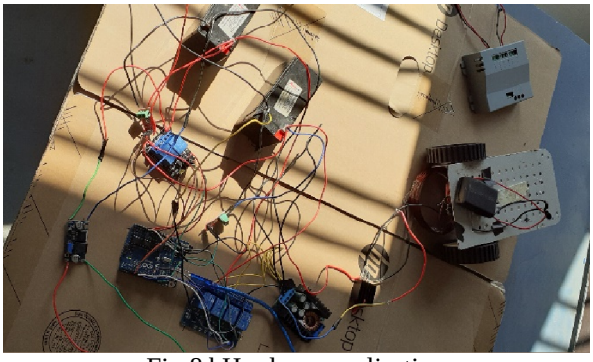

Fig 8 bHardware realisation

The measurement of voltage in the mutually coupled coils found to vary with distance. The experimental data showed appreciable variation with distance. It was observed that the voltage induced was 82% with a distance of 10mm. The voltage reduced to 64% when the distance is increased to 30 mm. The induced voltage reduces to half with 50 mm distance. There is a short of further 8% when the distance is doubled. It was also found that the air gap distance influences the efficiency of the coupled coils. The experiment was conducted with coils wound for 100 turns each in the primary and secondary. TTC5200 is employed for hardware realisation.

In this working of the PV and WIND system is established and the optimal solution for the wireless charging station techniques for electric car using renewable energy sources is obtained. And also the coil design and the battery design for hybrid cars is also discussed. However, if there is not proper alignment of primary and secondary coils the charging time of battery will increase.

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