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DEVELOPMENT OF RENAWABLE BASED CHARGING STATION FOR ELECTRIC VEHICLES

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ABSTRACT -In today's world, fossil fuel is the main power source as it provides energy for automobiles, airplanes, and it is also used to produce electricity. However, fossil fuel cause environment problembycreating energy through the release of CO2 into the atmosphere, which eventually causes global warming.For instance, automobiles accounted for 34.3% of global energy-related CO2 emissions in 2012. This demonstrates that in order to lower environmental pollution, changes to vehicle systems are required. Despite the fact that electric cars are typically thought of as clean cars, the process of producing power co uld generate emissions as well. This paper on a multifunctional solar charging station is a working solution to close the gap in achieving a truly renewable and clean vehicle.

In order to solve this problem, there are two paths: first, through designs which consume less energy and improve fuel efficiency; second through usage of alternative energy with storage such as hydrogen or battery. Recently, in the field of automobiles, many companies have developed commercially available electric cars that consume alternative fuels. Nevertheless, an electric car or electric vehicle is only as clean as the primary energy used to power it. That means we also have to look at clean electricity generation if we want to improve the traffic-based air pollution with electric vehicles.

In this project (RPFC) renewable, pollution free, and clean source of charging stations will be developed. This will result in reduction in fuel cost as electricity generation is using solar wind micro hydro power stations. This will also help in reduction of air pollution and global warming. Many government agencies will be ready to invest in such projects after successful development.

Keywords: Electric vehicle(EV),Plug-in electric vehicle(PEV),Direct current(DC).Alternating current(AC)

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I. INTRODUCTION

The electronics industry should anticipate a lot of activity surrounding local development and manufactu re given the national push to migrate to electric mobility and the government's enthusiasm for the deploy ment of electric vehicles.

Major OEMs are working on electric vehicles, but an ecosystem for software and cloud services, charger s, and charging stations is quickly developing as well. being built. Established companies as well as various start-ups, have started working on these areas and results are starting to show. Fortunately, India has seen successful solar deployment and the abundance of solar energy due to its geographic location. The one-time installation and capital expense, works well for at least 20-25 years, with the return on investment, taken care of in a few years. The energy input henceforth, becomes virtually free. The subsequent sections will illustrate a feasible implementation that may be adopted to harness solar energy, store it and use it for EV charging. It will touch upon energy harnessing & storage schemes, distributed battery management, power conversion and connectivity, which are the basic building blocks for a modular, scalable, solar powered EV charging station. A typical solar EV charging station implementation is depicted through the diagram - 1 below.

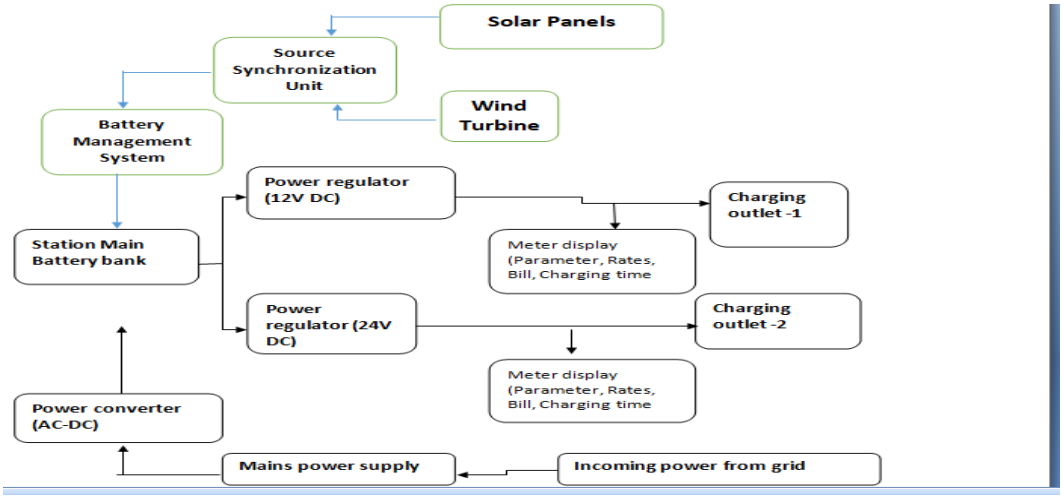

Fig.1- Block diaggram

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1.1 Methodology

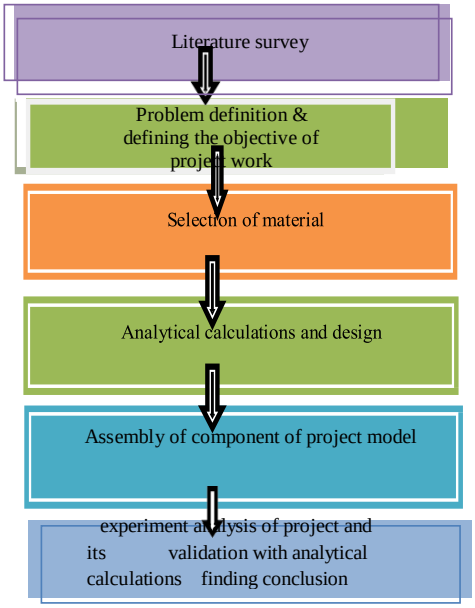

Figure 1.1 - Flow chart indicating the plan for the research work

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1.1.1 List Of hardware components

Sr. No.	Name Of Component	Specification	Quantity	Cost
1	Solar panel	12V DC, 40 Watt, Monocrystalline type.	1	2800
2	Storage battery	12V, 8AH Lead acid Battery	1	940
3	Voltage regulators	7805 7812	1 1	20 60
4	DC Ammeter & Voltmeters	0 – 24 V DC, 0-10 Amp DC	3	450
5	Dc generator	12V, 2 Amp, 1000 RPM	1	250
6	Boost Conversion Step Up chopper	XL6009 5 Amp Boost converter	1	400
6	Charging outlets	5m dc connectors male female type.	1	80
7	MOSFET	IRFZ44N	1	160
8	Step Down Transformer	230/12V DC	1	180
9	Bluetooth Module	HC-05 Bt Module	1	160
10	Connecting wires	1.5 sq.mm	10 mtr	200
11	Microcontroller	10 Bit Microcontroller	1	----
12	Solar Mounting Structure	Metal Fabrication	--	---
13	Wind Turbine Structure	Plastic Light Weight Blades,		
12	Miscellaneous	---	----	500-600

1.1.2 Hardware Material description

1) Battery Specifications

12V, 8AH Lead acid battery
12V 8Ah Sealed Lead Acid Battery with F1 Terminals

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2) Specifications

Sr.No	Specification	Range
1	DC output voltage	12V DC
2	DC input voltage	Upto 35V DC
3	Output current capacity	1.5 Amp
4	Operating junction temperatur	-55 to 150 celcius
5	Storage temprature	-65 to 160 celcius
6	Package used in our project	TO-220A Package(through hole package)
7	Short circuit current	2.5 amp for 1 milli seconds

1.1.3 General Information and purpose of use

In our project we have used 7812 voltage regulator for the voltage regulation purpose for controller. The L7800 series of three-terminal positive regulators is available in TO-220 ISOWATT220 TO-3 and D2PAK packages and several fixed output voltages, making it useful in a wide range of applications. These regulators can provide local on-card regulation, eliminating the distribution problems associated with single point regulation. Each type employs internal current limiting, thermal shut-down and safe area protection, making it essentially indestructible. If adequate heat sinking is provided, they can deliver over 1A output current. Although designed primarily as fixed voltage regulators, these devices can be used with external components to obtain adjustable voltages and currents.

FEATURES

- Low forward voltage drop
- Low leakage current
- High forward surge capability
- Solder dip 275 °C max. 10 s, per JESD 22-B106
- TYPICAL APPLICATION
- For use in general purpose rectification of power supplies, inverters, converters and freewheeling diodes application.
- These devices are not AEC-Q101 qualified.

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1) DC Geared generator

- Features
- Long-life:
- optimized brush design*1
- Continuous operating life of
- 3000 hours*1
- High output: High heat dissipation
- and heat resistance achieves higher
- output
- High strength: High radial load capacity due
- to robust construction, large diameter output
- shaft and ball bearings
- Low noise and increased insulation due to new resin
- brush holders
- Large selection of gear heads and reduction ratios are
- available to meet all needs

It is a general purpose chassis mounting mains transformer. Transformer has 240V primary windings and centre tapped secondary winding. The transformer has flying colored insulated connecting leads (Approx 100 mm long). The Transformer act as step down transformer reducing AC - 240V to AC - 12V. Power supplies for all kinds of project & circuit boards. Step down 230 V AC to 12V with a maximum of 1Amp current. In AC circuits, AC voltage, current and waveform can be transformed with the help of Transformers. Transformer plays an important role in electronic equipment. AC and DC voltage in Power supply equipment are almost achieved by transformer's transformation and commutation

A transformer is an electrical device that transfers electrical energy between two or more circuits through electromagnetic induction. Electromagnetic induction produces an electromotive force within a conductor which is exposed to time varying magnetic fields. Transformers are used to increase or decrease the alternating voltages in electric power applications. It is a step down transformer in which the secondary winding is more than primary winding. Due to this windings it can able to step down the voltage. A Transformer changes electricity from high to low voltage or low to high voltage using two Properties Of Electricity

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2) Solar panel

Speifications

Max Rated Power (Pmax)	40 Watts
Voltage at Max Power (Vmp)	17.3 Volts
Current at Max Power (Imp)	3.5 Amps
Open Circuit Voltage (Voc)	21.8 Volts
Short Circuit Current (Isc)	6.0 Amps
Length x Width x Depth (inches)	13.8x 11.8 x 0.98

3) Boost Converter Module

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XL6009 module is a non-isolated step-up boost voltage converter featuring adjustable output voltage, high efficiency. It converts input voltage of 5-32V DC to an output voltage of 4-38V DC.

Test Results:-

Input 3V Output 12V 0.4A 4.8W

Input 5V Output 12V 0.8A 9.6W

Input 7.4V Output 12V 1.5A 18W

Input 12V Output 15V 2A 30W

Input 12V Output 16V 2A 32W

Input 12V Output 18V 1.6A 28.8W

Input 12V Output 19V 1.5A 28.5W

Input 12V Output 24V 1 A 24W

Vin * Iin * Efficiency = Vout * Iout

Vin: Input Voltage

Iin: Input current

Vout: Output Voltage

Iout: Output current

4) Technical Parameters:-

- Module Properties: Non-isolated boost (BOOST)
- Rectification: Non-Synchronous Rectification
- Input Current: 4A (max), no-load 18mA (5V input, 8V output, no-load is less than 18mA. Higher the voltage, the greater the load current.)
- Conversion efficiency: <94% (greater the pressure, the lower the efficiency)
- Switching frequency: 400KHz
- Output Ripple: 50mV (the higher the voltage, the greater the current, the greater the ripple)
- Load Regulation: ± 0.5%

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II. DESIGN AND CALCULATIONS

1) Solar Panel Installation

Number of panels in array – 1
Weight of individual panel – 1600 gram (0.6Kg)
Mounting system weight – 400 gram (0.4kg)
Total weight of array – 2kg

Frame specifications

- Channel size – 340*1500mm square channel
- Material – Mild steel
- Thickness of the square pipe – 1mm
- Frame total height for the demo modal – 1.5 feet (45cm approximately)
- Frame welding type – Arc welding
- Frame total weight – 400 gram (Approximately)
- Frame ground fitting type – Nut bolt fitting with the mounting plates (M4 * 20 Bolts , M4 Nuts)

2) **Load calculations** – Average weight of the system 2Kg, (2Kg) Max

Consider,
design for 2kg
Total weight approximated – 2Kg
Size Of the materials According to weight

- Mild steel material is preferred from reduced cost point of view.
- Size Of the steel channel – 20*20 Square channels (Thickness – 1mm)
- Total length of the steel channel – 8 Feet approximately

3) Solar Panel tilt Angle

The optimum tilt angle is calculated by **adding 15 degrees** to your latitude during winter, and subtracting 15 degrees from your latitude during summer. For instance, if your latitude is 34°, the optimum tilt angle for your solar panels during winter will be 34 + 15 = 49°. The summer optimum tilt angle on the other hand will be 34 – 15 = 19°.

- Latitude for nashik, Maharashtra = 19.9
- Mounting angle for winter season = 19.9 + 15 = 34.5
- Mounting angle for summer season = 19.9 – 15 = 4.5 degrees

Since most of the sunlight available as per geography in the nashik areas is during summer season the mounting angle is kept constant at 15 dgrees. Thus need of keep changing the solar panel mounting axis.

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4) Electrical specifications of installation

- Wire connection type – 2sq.mm flexible wire for terminals of the solar
- Wire length – 1.5 feet height + 0.5 feet panel connection.
- Wire type – Multi stranded and multi cored wire
- Wire enclosure – Flexible spiral sleeve for external protection.
- Wire connectors – M3 Sized screw fitting
- Current calculation – 12Watt/12volt = 1 Amp
- Wire current capacity – Sq.mm * 3.5 = 2*3.5 = 7 Amp (Extra sized to reduce the voltage drop)

5) Wind turbine design calculations

1) Wind turbine type – Horizontal Axis wind turbine
2) Number of blades – 3 blade
3) Blade materials – PVC Light weight high strength material
4) Blade mounting angle = 360/3 = 120 degree
5) Blade length – 60cm
6) Blade width – 50mm
7) Blade tilt angle – 12 degrees approximately as per 10KMPH speed of the air and 12 watt average power output.
8) Wind generator – 12V DC, GEAED
9) Mounting type – Metal frame mountings
10) Basement / Foundation – MS plat – 1 kg
11) Wind turbine speed – 300RPM
12) Blade mounting plate – Dimension to be calculate (Circular a=with screw holes for blade fitting.

6) Battery design

- Total number of cells used – 3
- Cell type – 18650 Samsung cells (Lithium ion)
- Cells configuration – 3 Cells in series
- Per cell voltage – 3.7V (Full charged)
- Total terminal no load voltage – 11.5 V
- Battery (Cell) Current capacity – 2600 mAH (2.6Ah)

2) Battery charging time calculations

2.1) on solar based charging

- Battery charging time = Battery current capacity / Solar current capacity
  = 8000mAH /3000mA
  = 2.6 Hours
- On external wind turbine, 1amp capacity
  Battery charging time = Battery current capacity / wind turbine current capacity
  = 8000mAH / 1000mAmp
  = 8 Hours

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3) Batter backup

Batter backup = Batter current capacity / Current consumption
= 8000 mAh /16000mAmp
= 0.4 Hours (0.3 hours practically)

III RESULT

Even though they are seen as an environmentally beneficial alternative, electric cars (EVs) nonetheless c ontribute to global warming because of greenhouse gas emissions; this is especially true if the electricity needed to power EVs is produced from traditional energy sources.

The global market for EV charging stations is home to a number of businesses, including Tesla, ABB, S iemens AG, Charge Point, Leviton Manufacturing, Schneider Electric, and Magenta Power.

This issue is resolved by producing electricity using renewable energy sources, such as solar power. maximizing the green impact of EVs. It is true that the production of solar panels results in carbon emissions but they become carbon neutral in a few years and last for 15 to 20 years, on an average. The adoption of electric mobility, not only by customers but even the auto industry, depends a lot on the growth of the EV charging infrastructure. A solar charging station usually consists of EV supply equipment (EVSE), an array of solar panels, an inverter to convert solar power from DC to AC, an energy storage system (for off-grid charging), charge controllers and a secure network for the wireless transmission of data to help users make real-time decisions. In the case of on-grid charging, solar power is fed into the grid regardless of the need for it, and electricity is drawn from the grid, which guarantees charging and the optimum use of solar power. This is a cheaper option compared to charging off-grid. In the case of off-grid charging, a solar panel connects to the energy storage system from which the power is drawn. Such chargers can be placed anywhere since they do not have to connect to the grid. A heavy steel base plate usually acts as a solid foundation, making it easy to install the system

IV. CONCLUSION

The introduction and distribution of EVs have increased in both industrialised and developing nations.
The government has taken the lead in promoting the next generation of environmentally friendly cars in in dustrialised nations.Solar and wind energy, two renewable energy sources, will make this possible.
Large and small businesses, in addition to traditional automakers, have entered the EV market in the indus trial world as new business potential.
The general public has high expectations for EVs, which is in line with the execution of several pilot proje cts and EV-related events. But there's no obvious indication for full-fledged diffusion. This is because of high prices of EVs, limited models, lack of charging infrastructure. This problem of lack of charging infrastructure is the one of major issue stopping electric v3hicles from becoming popular. Design and development of solar charging station integrated with wind turbines will help us to make electric mobility more and more popular.

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