"HYBRID POWER UNIT OF ELECTRIC VEHICLE CHARGING STATION "

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Abstract

When it comes to electrical technology Electric vehicles are crucial for reducing greenhouse gas emissions and energy consumption. The electrical power sector is changing quickly. The main factors that will determine how quickly these changes take place are the rising cost of energy, the widespread electrification of daily life, and global warming. Regardless of how quickly different utilities adopt new grid concepts, technologies, and systems, they all concur that this significant transition is inevitable. One of the most crucial aspects of the electric car business is the charging station, which needs to be able to keep up with the rapid development of electric vehicles. The absence of charging facilities is the main reason why consumers don't favour electric automobiles. Regarding electrical technology Electric vehicles are crucial for energy conservation and the reduction of harmful greenhouse gas emissions. Rapid transformation is being implemented in the electrical power sector. Rising energy prices, widespread electrification of daily life, and global warming are the main forces that will determine how quickly these changes take place.

Keywords: - *Auto-changeover unit, Battery Energy Monitoring, Electrical Vehicle, Hybrid Energy Source,GSM 900A,IOT,Solar Panel.*

1.Introduction:-

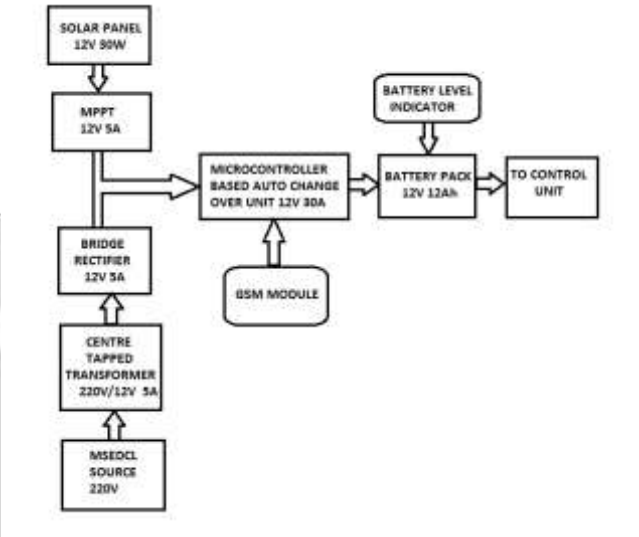
A universal charging station provides dependable charging for vehicles made by many manufacturers with various batteries and charging capacities. This increases demand for EVs. The simplest way to understand this idea is to realise that the charging mechanism operates by just changing Current and Voltage to give the precise amount of power needed by the battery for rapid charging. Power supply is regulated by the controllers. The power unit and control unit are the two separate components of this model. The power unit supplies customers with high-quality power, while the control unit manages the output of the charging station. The setup is also continually checked to ensure that it is a flawless one with no danger of electricity theft. The product is an IOT-based, secure platform that can be customised and offers users a plug-in for charging when necessary. Solar energy is a renewable energy source that is unrestricted, pure, cost-free, and environment friendly. It is therefore extremely effective and pollution-free. The complete adoption of a transport system powered by renewable energy is prompted by the worrisome state of global warming. However, it has been difficult to deploy them sustainably on a large scale.

2. Problem Statement and Solution:

Now a days due to increasing demand of Electrical Vehicle in India there is some how increasing burden of Electricity demand on several power generating plants such as thermal power plants, nuclear power plants,

hydro power plants, etc. This is indirectly leading to Affect the Environment and raising problem of Global warming. So can we use renewable energy to charge EV's ? answer is Yes, we have used Solar pad to charge EV's. But what during Night duration or during Rainy seasons, can we charge EV's in case of Rainy season or night duration ? answer is Absolutely Yes, Because we have also used MSEDCL source to charge EV's .but what if both the sources i.e solar energy and MSEDCL source are unavailable, so Battery is used as a backup source to charge EV's. Most of the Charging Station are unable to provide service for 24 hrs but this Hybrid EV charging station provides 24 hrs charging service to the customer with hassle free.

3. Block Diagram and Methodology :



The charging of EVs will take place outside with a voltage of 220v. Additionally, a solar panel is added, which is used to extract the solar energy and convert it into regulated DC power. The panel has its respective solar charge controller, which regulates the voltage flow into the battery. The vehicle which is to be charged has been scaled down and assumed to be a battery of 12v and 4.5Ah. The solar charge controller extracts the power from the Sun's solar radiation, steps down the voltage, and supplies it to the battery accordingly. The EVCS contains 1 SPDT relay that switch automatically in delivering power. Relay is turned off in the absence of the Sun, and Relay is active, usable for power delivery During the day, in bright sunlight, the user can use either solar energy or conventional electricity from the grid. **The SPDT Relay which is present can be activated based on therequirement.** The Two possible ways are explained:

Case 1: Solar Charging -

In the presence of sunlight, As 12 V solar panel supply is given to Relay energizing coil,then Relay NC contact (which is connected to MSEB source Becomes No contact and NO contact(Which is connected to Solar panel) becomes NC contact, thus EV is charged via Solar Panel The solar radiations are converted into electricity and pass through the solar charge controller. The solar charge controller is a voltage and current regulator to keep batteries from overcharging and overheating. It regulates the to current and voltage coming from the solar panels and going to the battery safe guarding it by preventing it from over-voltage, low voltage, and back current. **Whenever EV is charging via Solar panel MSEB source gets automatically Cut off.**

Case 2: Electric grid charging -

During cloudy whether or during night time solar output is unavailable at this condition as a first backup supply MSEB source is used to charge EV. As Relay only operates at 12V of solar panel but during cloudy area or night time solar output voltage is less then 12V which may not energize relay coils thus providing MSEB source to charge EV When the charging sequence begins, it is ensured that the power is supplied from one source only. When EV is connected to charging ports Micro controller recognises the user as a trusted source and sends signal to the relay. The relay then closes the circuit as per condition providing power flow. A Analog Volmeter and Ammeter is placed, and which is providing output voltage and current. power consumed is monitored consistently. The consumer's information is recorded and stored in the server,

and the number of units consumed along with the per-unit cost is calculated. Once the charging is complete, the circuit is disengaged, and the relay turns off the current flow. The energy meter tracks the power consumption and stores the data, which is later sent to the consumer's phone. After disengaging the supply or completing the charge, the payment gateway is opened, and the transaction is made. This completes the entire process of charging an EV. The charging of the EVs is made easy, hassle-free, and secure. It also ensures that the electricity is not stolen and solely used to charge the respective EVs.

4. Hardware :

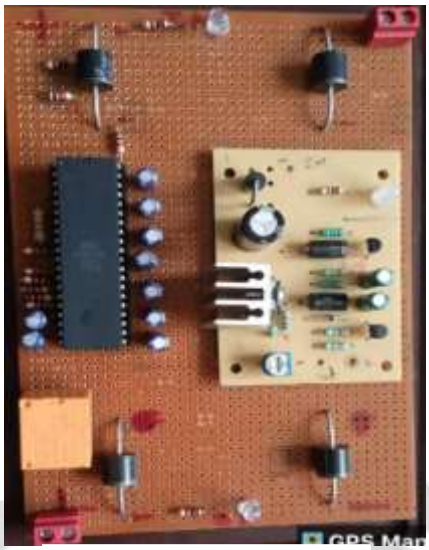
4.1 Solar Panel

Charging Point solar power is another option. Utilising solar energy can reduce the load on the grid and minimise the need for fossil fuels. The use of distributed solar energy for charging electric vehicles would be a great way to solve the aforementioned problem and produce net-zero emissions. We could quickly transition to a green endeavour if we used solar electricityThere are Two types of solar pads i.e Monocrystalline and Polycrystalline but here we have used Monocrystalline solar pad because its solar absorbing efficiency is more as compared to others.

Benefits of Solar EV Charging :

Overall running cost of EV charging Station is Reduced.Beneficial during peak hours (Summer climate) Solar eliminates these needs for non-renewable energies and helps boost the sustainability initiatives at the heart of the EV industry. The combination of solar energy and battery storage allows you to fuel your electric vehicle during Power outages and low sunlight.

4.2 Maximum Power Point Tracker



Rating: 12V 30A

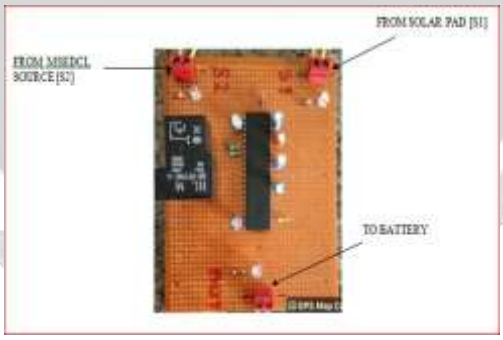
An electronic DC to DC converter called an MPPT, or maximum power point tracker, optimises the compatibility between the solar array (PV panels) and the battery bank or utility grid. Simply put, they reduce the greater DC output voltage from solar panels (and a few wind turbines) to the lower voltage required to charge batteries. provide you an increase that ranges from 15% in winter to 35% in summer. In order to get the most power out of a PV module under particular circumstances, like rainy or overcast weather.

The following circumstances make MPPT most effective:

• PV modules often perform better in the summer, and MPPT is used to get the most electricity possible from them.

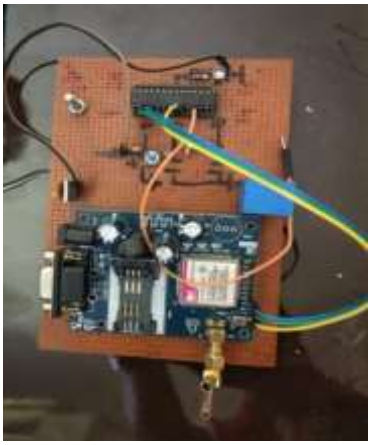
• If the battery's state of charge decreases when it is deeply drained, MPPT can extract more current and recharge the batter

4.3 Smart Auto Change-Over Unit Using Inductive Relay



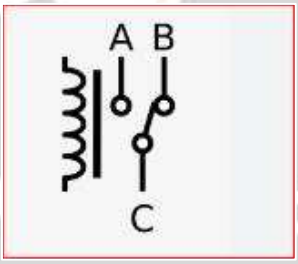
This is the most essential part of the project Smart auto change over switch automatically transfers Power supply from Primary Source(Solar Pad) to a Auxiliary MSEDCL source when it senses failure or outage in primary source. Mainly we are going to supply maximum solar power to charge EV, but in case of night or rainy seasons we can’t provide solar power so auto change over switch transfers it to MSEDCL supply immediately. Here we have used SPDT(single pole double throw relay).This Automatic Process is controlled by using Programmed microcontroller. The microcontroller used is of Atmega 328P

4.4 GSM Module [900a]



This wireless module is highly compact and dependable. It is the SIM900A, a SMT module that offers a complete Dual-band GSM/GPRS solution and can be incorporated in customer applications. The SIM900A boasts an industry-standard interface and provides GSM/GPRS 900/1800MHz performance for voice, SMS.Whenever EV starts Charging GSM sends Text message to customers mobile that "System is OK EV is Charging" and Whenever System is stoped Then its sends message that "System is Stoped"

4.5 SPDT Relay



Rating : 12V 30A

SPDT relays are commonly used in control systems, where they can be used to switch between two different circuits or to switch a single circuit on or off. For example, an SPDT relay could be used to switch between two different lighting circuits or to control a motor by switching the power supply on or off.When no supply is given the COM is connected to NC. When the operating voltage is applied the relay coil gets energized and the COM changes contact to NO.It can easily be turned (ON) or (OFF) and let the current go through or not, and the relay can also control it with very low voltages of 3.3V,5V,9.6V connected to a battery provided by the Arduino pins.

4.6 Centre-Tapped Transformer

Here Centre Tapped Transformer of 220V/12V is used. At output of Transformer 12-0-12 voltage is achieved. Solid core and pure copper winding transformer is used which has high efficiency then others.

- Input Voltage: 230V AC
- Output Voltage 12V, 12V or 0V
- Output Current: 5 Amp
- Mounting: Vertical mount type
- Winding: Copper

4.7Rectifier

To control the voltage supply and maintain a consistent supply, we need a voltage regulator.12v/5v/6v DC to 220/230 V AC Bridge Rectifier with Regulated Power for DC Conversion as needed.It's not simple to go from AC to DC. Using a step down transformer, the voltage is reduced in the AC to DC conversion process' first stage. The second stage involves rectifying the signal, which is done using rectifiers.The fourth stage is regulation, which increases the signal's stability so that it can be supplied continuously to the circuit. The continuous signal is created using a regulator ic or a Zener diode.

Components :

- 12-0-12 1 A transformer
- Diode in 4007-4
- Capacitor 1500uf 25v-1, 0.1uf-2
- LM7805 ic-1,for 5v and 7812 for 12v
- If You need 9v dc then use 7809 and 7805 for 5v

4.8 Battery Bank

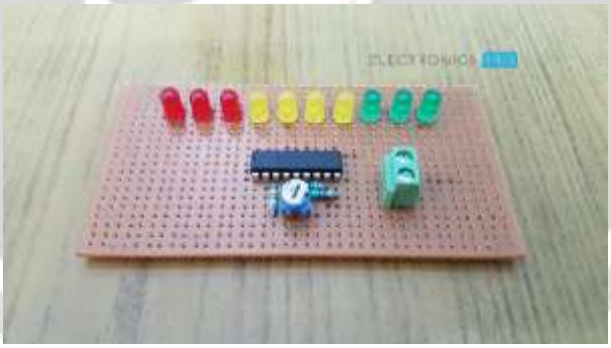
The category of secondary batteries includes lead-acid batteries. Reversible chemical processes take place in secondary cells. By

sending a current through the battery (recharging), the reactants that produce an electric current in these batteries (through chemical reaction) can be replenished.The sealed lead-acid battery has six cells that are arranged in a single container.

Why Battery is used in charging station ?

We have used lead acid battery(12v 12amph) due cost consideration but we can also use lithium ion battery as it had feature of fast charging and low leakage discharging. When both supply i.e Grid supply and solar panel supply are not available this battery provides further dc supply to load

4.9 Battery Health Monitoring



The LM3914 IC is the brains of this battery level indicator circuit. This IC uses an analog input voltage to drive 10 LEDs linearly in accordance with that input voltage. Because the IC controls the current in this circuit, resistors do not need to be connected in series with the LEDs. This circuit's LEDs 10 LED show the battery's capacity .The potetiometre resistor regulates the LEDs' brightness. Here, calibration is done using pot RV1. This circuit doesn't require any external power sources.The circuit is intended to monitor DC voltages of 10V to 16V.

5. Result :

we have Considered EV battery pack is of three batteries connected in parallel of 12V 1.5Ah.

Total rating EV battery pack=12V 4.5Ah.

Solar panel =18V

Note – MPPT steps down & provides constant voltage of 12V to charge EV.

Power rating of battery

P=12*4.5

P=54W

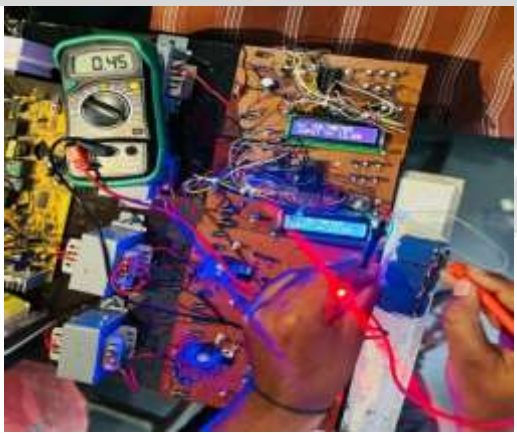
Charging current required for 4.5Ah battery in 2 hrs is 4.5Ah/2 = 2.25 A

we have successfully charged EV battery with following observation.

Sr.No.	Voltage	Current	Time (PM)
1.	11.43	0.95	1:35
2.	11.50	0.45	1:50
3.	11.55	0.16	2:05
4.	11.76	0.08	2:20
5.	12.05	0.07	2:35
6.	12.16	0.06	2:50
7.	12.34	0.054	2:55
8.	12.35	0.04	3:05
9.	12.38	0.05	3:20
10.	12.41	0.03	3:35

Reading 1

Reading 2



7. Conclusion :

This Research paper concludes that the project Hybrid EV Charging Station can provide hassle free 24/7 hrs charging to customer and as solar pads are used there is 100% reduction of fossil fuel and reduces dependance on power station . Overall energy consumption is monitored and also smart battery monitoring system is used which keeps battery at safe voltage and current maintaining Life cycle of battery.

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