International Journal of Research in Engineering, Science and Management
Volume-3, Issue-2, February-2020
www.ijresm.com | ISSN (Online): 2581-5792

Solar with Coin Box Based EV Charging Station

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Abstract*: This paper investigates the possibility of charging the battery electric vehicle at workplace using solar energy. Electric power must become less depend on fossil fuels and transportation must become more electric to decrease carbon emissions and mitigate climate change. Increasing availability and accessibility of charging stations is predicted to increase purchases of electric vehicles. Every hour, the sun emits more energy onto the earth's surface than our entire world population uses in one year. Solar power provides us with the possibility of a cleaner and more renewable future. Global climate change as a result of greenhouse gases and the effects of low air quality caused by pollutants have become very substantial issues in our world today. The costs associated with greenhouse gas and air pollutant emissions, and the effect they have on human lives and human health, are the major and growing concerns. The development & installation of solar powered charging stations will reduce the amount of greenhouse gases emitted into the atmosphere, future costs related with climate change, and health issues. Thus, there is environmental, social, and economic value related with the installation of solar powered charge stations. Solar powered charging stations have the potential of significantly reducing air pollutants and improving urban air quality. The electrification of transportation and the use of solar powered charging stations as an electricity source will improve people's quality of life. Carbon dioxide is one of the principle greenhouse gases, which causes global warming and climate change.85 % of the high levels of greenhouse gases in the transport sector, including carbon dioxide, can be affected to vehicle emissions. The atmospheric carbon dioxide concentrations in May 2014 reached 401.88 parts per million, 50 parts per million over the safety limit for carbon dioxide levels. There are some social, environmental, and economic implications related with electric vehicles replacing internal combustion vehicle. All electric vehicles have no tailpipe emissions, which improves air quality & reduces health risks. Electric vehicles also help the nation to reduce its reliance on foreign fossil fuels. Electric vehicles have one- tenth the number of parts that gasoline- powered vehicles have, thus requiring less maintenance and saving drivers time and money. Electric vehicle owners can save about 46% in annual maintenance costs.

***Keywords*: EV charging station.**

1. Introduction

All electric vehicle charging station, is an element in infrastructure that supplies electric energy for the recharging of plug-in electric vehicles- including electric cars, neighborhood electric vehicles and plug-in hybrid electric vehicles. Charging station falls into three basic categories:

1. *Residential Charging Station:* A residential Charging station usually has no user, authentication, no metering, and may require wiring a dedicated circuit. some portable chargers can also be mounted as a charging station.
2. *Charging while parked:* A commercial venture for a fee or free, offered in partnership with the owners of the parking lot. This charging may be slow or high speed and encourages EV owners to recharge their cars while they take advantages of nearby facilities. It can include parking station, parking at mall, small centers, and train station.
3. *Fast charging at public charging station:* These have rating more than 40kw, capable of delivering over 60-miles (97km) of range in 10-30minutes. This charger may be at rest stop to allow for longer distance trips. they may also be used regularly by commuters in metropolitan areas, and for charging while parked for shorter or longer periods.

Historically, mobility and fossil fuels have been inextricably linked with electric vehicles being successful only in a few niche markets. However, over the last decade, a collection of circumstances has conspired to create an opening for electric vehicles to enter the mass market. Those reasons include:

1. *Climatic change* - The prospect of rapid global temperature increase has created the need for a reduction in the use of fossil fuels and the associated emissions. India has committed to cutting its GHG emissions intensity by 33% to 35% below 2005 levels by 2030.
2. *Advance in Renewable energy*: Over the last decade, advances in wind and solar electricity generation technologies have drastically reduced their cost and introduced the possibility of clean, low- carbon and inexpensive grids. India proposed to add 175 GW of renewable energy capacity by 2020 and to achieve 40 % of its electricity generation from non – fossil sources by the same year.
3. *Rapid urbanization:* Economic development, especially in emerging economies, is creating a wave of urbanization as rural populations move to cities in search of employment. While urbanization is an important component of the process of economic development, it also stresses upon the energy and transport infrastructure leading to congestion and pollution. According to a recent study by WHO, India

is home to 14 out of 20 most polluted cities in the world. Electric vehicles (EV's) can improve that scenario by reducing local concentrations of pollutants in cities.

4. *Data capture and analysis:* with the rise of GPS enabled smart phones and the associated universe of mobility applications, mobility has undergone a digital revolution. That digital revolution has created possibility of a greater utilization of existing transportation assets and infrastructure. For EV's, which rely on lower variable costs to offset relatively high fixed costs, this enhanced utilization is a critical element of achieving total costs of ownership compared to internal combustion vehicles.
5. *Battery chemistry*: Advances in battery technology have led to higher energy densities, faster charging and reduced battery degradation from charging. Combined with the development of motors with higher rating and reliability, these improvements in battery chemistry have reduced costs and improved the performance and efficiency of electric vehicles.
6. *Energy security:* The petrol, diesel and CNG needed to fuel an internal combustion engine (ICE) based mobility system requires an extensive costly supply chain that is prone to disruption from weather, geopolitical events and other factors. India needs to import oil to cover over 80% of its transport fuel. That ratio is set to grow as a rapidly urbanizing population demands greater intra – city and inter – city mobility. As a result, developed economies such as EU, the USA and japan as well as developing economies such as china and India have all included Electric vehicles (EV) in their policies to lower their carbon emissions while providing convenient and cost – effective mobility.

The key objectives of the EV policy are:

1. Reduce primary oil consumption in transportation.
2. Facilitate customer adoption of electric and clean energy vehicles.
3. Encourage cutting edge technology in India through adoption, adaptation and research and development.
4. Improve transportation used by the common man for personal and goods transportation.
5. Reduce pollution in cities.
6. Create EV manufacturing capacity that is of global scale and competitiveness.
7. Facilitate employment growth in a sun-rice sector.

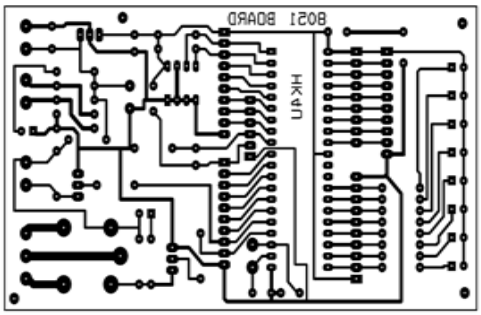
The solar power application to battery charging has been studied in the past. Solar chargers convert light energy into DC current for a range of voltage. The design and development of a coin box based EV vehicle charging station main power and solar power is discussed.

Basic assumption,

1. Maximum solar energy is used for charging the lead acid battery.
2. The charging current is up to 4.5AH @ 12v DC.
3. A single solar panel of size 635*550*38mm,37wp capable of supplying up to 2.0 Amp is used.

2. Proposed methodology and operating principle

A. *PCB designing and soldering designing*



1) PCB designing:

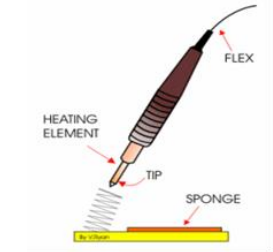
- Design your circuit board. Use PCB computer-aided design (CAD) software to draw your circuit board. You can also use a perforated board that has pre-drilled holes in it to help you see how your circuit board's components would be placed and work in reality.
- Buy a plain board that is coated with a fine layer of copper on one side from a retailer.
- Scrub the board with a scouring pad and water to make sure the copper is clean. Let the board dry.
- Print your circuit board's design onto the dull side of a sheet of blue transfer paper. Make sure the design is oriented correctly for transfer.
- Place the blue transfer paper on the board with the circuit board's printed design against the copper.
- Lay a sheet of ordinary white paper over the blue paper. Following the transfer paper's instructions, iron over the white and blue paper to transfer the design onto the copper board. Iron every design detail that appears near an edge or corner of the board with the tip of the iron.
- Let the board and blue paper cool. Peel the blue paper slowly away from the board to see the transferred design.
- Examine the transfer paper to check for any black toner from the printed design that failed to transfer to the copper board. Make sure the board's design is oriented correctly.
- Replace any missing toner on the board with ink from a black permanent marker. Allow the ink to dry for a few hours.
- Remove exposed parts of the copper from the board using ferric chloride in a process called etching.
- Put on old clothes, gloves and safety goggles.
- Warm the ferric chloride, stored in a non-corrosive jar and sealed with a non-corrosive lid, in a bucket of warm water. Do not heat it above 115 F (46 C) to prevent toxic fumes from being released.
- Pour only enough ferric chloride to fill a plastic tray that has plastic risers in it to rest the circuit board on.

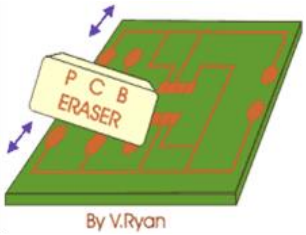
Be sure to do this in a well-ventilated space.

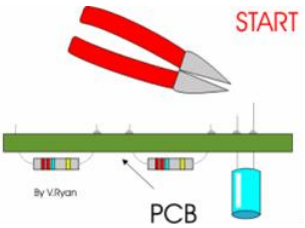
- Use plastic tongs to lay the circuit board face down on the risers in the tray. Allow 5 to 20 minutes, depending on the size of your circuit board, for the exposed copper to drop off the board as it etches away. Use the plastic tongs to agitate the board and tray to allow for faster etching if necessary.
- Wash all the etching equipment and the circuit board thoroughly with plenty of running water.
- Drill 0.03 inch (0.8 mm) lead component holes into your circuit board with high-speed steel or carbide drill bits. Wear safety goggles and a protective mask to protect your eyes and lungs while you drill.
- Scrub the board clean with a scouring pad and running water. Add your board's electrical components and solder them into place.

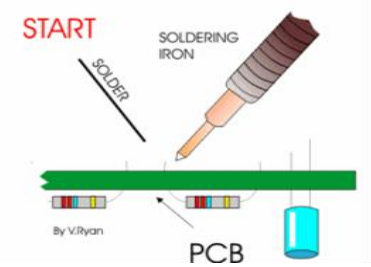
2) Soldering techniques

So Soldering is the only permanent way to 'fix' components to a circuit. However, soldering requires a lot of practice as it is easy to 'destroy' many hours preparation and Design work by poor soldering. If you follow the guidelines below you have a good Chance of success.









A PCB eraser is used to remove any film from the tracks. This must be done carefully. Because the film will prevent good soldering of the components to the PCB. The tracks can be checked using a magnifying glass. If there are gaps in the tracks, sometimes they can be repaired using wire but usually a new PCB has to be etched.

Use a soldering iron in good condition. Inspect the tip to make sure that it is not past good operation. If it looks in bad condition it will not help you solder a good joint. The shape of the tip may vary from one soldering iron to the next but generally they should look clean and not burnt. The heated soldering iron should then be placed in contact with the track and the component and allowed to heat them up. Once they are heated the solder can be applied. The solder should flow through and around the component and the track. Having completed soldering the circuit the extended legs on the components need to be trimmed using wire clippers. The circuit is now ready for testing.

3. General components

1. Resistor
2. Capacitor
3. Transistor
4. Relay
5. Integrated circuit
6. LCD Display

1) Resistors

In many electronic circuit applications, the resistance forms the basic part of the circuit. The reason for inserting the resistance is to reduce current or to produce the desired voltage drop. These components which offer value of resistance are known as resistors. Resistors may have fixed value i.e., whose value cannot be changed and are known as fixed resistors. Such of those resistors whose value can be changed or varied are known as variable resistors.

There are two types of resistors available. They are:

- Carbon resistors.
- Wire wound resistors.

Carbon resistors are used when the power dissipation is less than 2W because they are smaller and cost less. Wire wound resistors are used where the power dissipation is more than 5W. In electronic equipment's carbon resistors are widely used because of their smaller size.

All resistors have three main characteristics:

- Its resistance R in ohms (from 1 ohm to many mega ohms).
- Power rating (from several 0.1W to 10 W).
- Tolerance (in percentage).

2) Capacitors

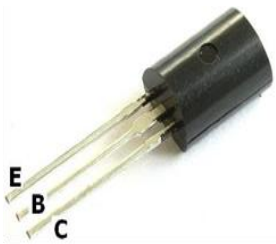
Devices which can store electronic charge are called capacitors. Capacitance can be understood as the ability of a dielectric to store electric charges. Its unit is Farad, named after the Michael Faraday. The capacitors are named according to the dielectric used. Most common ones are air, paper, and mica, ceramic and electrolytic capacitors.

Physically a capacitor has conducting plates separated by an insulator or the dielectric. The plates of the capacitor have opposite charge, this gives rise to an electric field. In capacitor the electric field is concentrated in the dielectric between the plates.

Like resistors, capacitors are also crucial to the correct working of nearly every electronic circuit and provide us with a means of storing electrical energy in the form of an electric field. Capacitors have numerous applications including storage capacitors in power supplies, coupling of A.C. signals between the stages of an amplifier, and decoupling power supply rails so that, as far as A.C. signal components are concerned, the supply rails are indistinguishable from zero volts.

3) Transistor

The transistor an entirely new type of electronic device is capable of achieving amplification of weak signals in a fashion comparable and often superior to that realized by vacuum tubes. Transistors are far smaller than vacuum tube, have no filaments and hence need no heating power and may be operates in any position. They are mechanically strong, hence practically unlimited life and can do some jobs better than vacuum tubes.



Invented in 1948 by J. Bardeen and W. H. Brattain of Bell Telephone Laboratories, a transistor has now become the heart of most electronic appliance. Though transistor is only slightly more the 45 years old, yet it is fast replacing vacuum tubes in almost all applications.

A transistor consists of two pn junction formed by sand witching either p-type or n-type semiconductor between a pair of opposite type. Accordingly, there are two types of transistors namely:

- n-p-n transistor
- p-n-p transistor

An n-p-n is composed of two n-type semiconductors separated a by thin section of p-type. However, a p-n-p is formed by two p-section separated by a thin section of n-type.

- These are two pn junctions. Therefore, a transistor may be regarded as a combination of two diodes connected back to back.
- There are 3 terminals, taken from each type of semiconductor.
- The middle section is very thin layer. This is the most important factor in the functioning of a transistor.

Origin of the name “transistor “: When new devices are invented, scientists often try to device a name that will appropriately describe the device. A transistor has two pn junctions. As the discussed later one junction is forward biased and the other is reversed biased. The forward biased junction has low resistance path whereas the reverse biased junction has low resistance path whereas the reverse biased junction has a high resistance path. The weak signal is introduced in the low resistance circuit and output is taken from the high resistance circuit. Therefore, a transistor transfers a signal from a low resistance to high resistance. The prefix ‘tans’ means the signal transfer property of the device while ‘istor’ classifies it as a solid element in the same general family with resistors.

4) Relay

A relay is an electrically operated switch. Many relays use an electromagnet to operate a switching mechanism mechanically, but other operating principles are also used. Relays are used where it is necessary to control a circuit by a low-power signal (with complete electrical isolation between control and controlled circuits), or where several circuits must be controlled by one signal. The first relays were used in long distance telegraph circuits, repeating the signal coming in from one circuit and re-transmitting it to another. Relays were used extensively in telephone exchanges and early computers to perform logical operations. A type of relay that can handle the high power required to directly drive an electric motor is called a contactor. Solid-state relays control power circuits with no moving parts, instead using a semiconductor device to perform switching. Relays with calibrated operating characteristics and

sometimes multiple operating coils are used to protect electrical circuits from overload or faults; in modern electric power systems these functions are performed by digital instruments still called "protective relays".

5) Integrated circuits

All modern digital systems rely on the use of integrated circuits in which hundreds of thousands of components are fabricated on a single chip of silicon. A relative measure of the number of individual semiconductor devices within the chip is given by referring to its 'scale of integration'. The following terminology is commonly applied.

6) LCD Display

LCD indicate different mode setting and When coin insert on coin box then "COIN INSERT" indicate on display.

4. Results

1. Although electric vehicles reduce carbon emission and reliance on foreign oil, emission issues are still present if fossil fuels are used for electricity generation.
2. Electric vehicles charged using solar power emit 96% less mass of pollutants than other electric vehicles using the grid.
3. Photovoltaics emits no noise, chemical pollutants or radioactive substance during use, so they are not added nuisances to the surrounding community.
4. Reducing carbon emission using solar power will help the nation reach proposed US federal plans to reduce the nation's 2005 carbon emission levels by 30% from the electric power sector by 2030.

5. Conclusion

In order to decrease carbon emission, electric power must be less dependent on fossil fuels and transportation must be electric. This paper examines the possibility of creating and electric vehicle charging infrastructure using solar panel. A system is designed for use in workplaces to charge electric vehicle the motive is to maximize the use of solar energy for EV charging with minimum energy exchange with the grid.

References

[1] U. S. Energy Administrative (EIA). International Energy Outlook, ReportNo.: DOE/EIA-0484(2013). Washington, Dc: Office of Energy Analysis, U.S. Department of Energy,201320585
[2] Organization of the Petroleum Exporting Countries. World Oil Outlook, Report No.: ISBN978-3-9502722-6-0. Helferstorferstrasse17, A-1010 Vienna, Austria: OPEC; 2013.
[3] Yimin Zhou, Xiaoyun Li, "Vehicle to Grid Technology: A Review", Proceedings of the 34th Chinese Control Conference July 28-30, 2015, Hangzhou, China
[4] Dale hall, Nic Lutsey, "Literature review on power Utility best practices Regarding electric vehicles", ICCT White Paper 2017.
[5] Vehicles Ebrahem Mortaz, Jorge Valenzuela, "Microgrid energy scheduling using storage from electric vehicles", 2016.
[6] Chiao-Ting Li, Changsun Ahn, Huei Peng, and Jing Sun, "Integration of Plug-In Electric Vehicle Charging and Wind Energy Scheduling on Electricity Grid", IEEE 2011.