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Photovoltaic Powered Wireless Electrical Vehicle Charging System

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KEYWORDS

Power flow, : Battery; Micro Controller; Embedded System; Transformer; Microprocessor; Electric Vehicle;

ABSTRACT

In modern World is shifting towards electrified mobility to reduce the pollutant emission caused by non-renewable fossil fuel vehicles. So electric vehicle came into existence. In electric vehicle charging of battery through charger and wire is expensive, hazardous and inconvenient and drawback of wire charging technology is waiting at charging stations for hours. So now wireless charging gives us opportunity to charge our vehicle just by parking the vehicle on parking spot or even while driving we can charge our electric vehicle. As if now we are very much familiar with wireless transmission of data, audio and video signals than why not transfer power over the air.. Wireless power transfer can be implemented as a static and dynamic charging system. This paper presents how the electric vehicle and development of charging methods. This project describes the design of solar powered charging station for charging of electric vehicle describes design of solar powered charging station for charging of electric vehicle that solves the key downside of fuel and pollution. Electric vehicles have now hit the road worldwide and are slowly growing in numbers. Apart from environmental benefits electric vehicles have also proven helpful in reducing cost of travel by replacing fuel by electricity which is way cheaper. Well here we develop an EV charging system that solves with a unique innovative solution. This EV charging of vehicles without any wires, No need of stop for charging, vehicle charges while moving, Solar power for keeping the charging system going, No external power supply needed. The system makes use of a solar panel, battery, transformer, regulator circuitry, copper coils, AC to DC converter, Atmega controller and LCD display to develop the system. The system demonstrates how electric vehicles can be charged while moving on the road, eliminating the need to stop for charging. Thus the system demonstrates a solar powered wireless charging

1. INTRODUCTION

Electric Vehicles (EVs), represents a new concept in the transport sector around the world. It is expected that the market share of EVs will exponentially grow, comprising 24% of the U.S. light vehicle fleet in 2030, representing 64% light vehicle sales in this year. In this context, the EVs battery charging process must be regulated to preserve the power quality in the power grids. Nevertheless, with the proliferation of Evs a considerable amount of energy will be stored in the batteries, raising the opportunity of the energy flow in the opposite sense. In the future smart grids, the interactivity with the EVs will be one of the key technologies, contributing to the power grid autonomous operation. The concept of the on-board bidirectional charger with V2G and V2H technologies is introduce integration not only supports power generation but also improves voltage stability and system performance. This project focuses on improving the voltage profile of weak buses in the IEEE 14-bus system by integrating renewable generation sources.

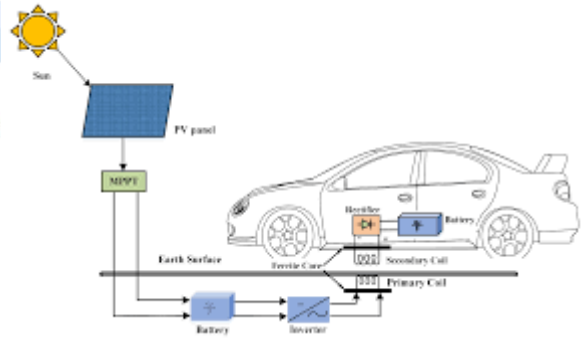
The electric vehicle has become more competitive when compared to the conventional internal combustion engine vehicle due to lower carbon dioxide emission and raising fossil fuels. However, the EV was not widely adopted into the market due to some limitations such as high vehicle cost. limited charging infrastructure and limited all electric drive. EVs are vehicles that are either partially or fully powered on electric power. Electric vehicles have low running costs as they have fewer moving parts for maintenance and are also very environmentally friendly as they uselittle or no fossil

OBJECTIVES

The objective of a solar wireless electric vehicle system is to develop an efficient, sustainable, and intelligent charging solution that integrates solar energy generation with wireless power transfer technology to charge electric vehicles without physical connections, thereby reducing dependence on conventional fossil fuels and minimizing transmission losses; this system aims to utilize photovoltaic panels to harness renewable energy, convert and store it effectively using advanced power electronics, and transmit power wirelessly through inductive or resonant coupling, while incorporating smart control strategies to optimize energy usage, improve charging efficiency, ensure safety, and support grid independence, ultimately promoting eco-friendly transportation, reducing carbon emissions, and enabling convenient, reliable, and future-ready electric mobility infrastructure

2. ELECTRIC VEHICLE

An electric vehicle (EV) is a vehicle that uses one or more electric motors or traction motors for propulsion. An electric vehicle may be powered through a collector system by electricity from off-vehicle sources, or may be self-contained with a battery, solar panels, fuel cells or an electric generator to convert fuel to electricity[4]. EVs include, but are not limited to, road and rail vehicles, surface and underwater vessels, electric aircraft and electric spacecraft. EVs firstcame into existence in the mid-19th century, when electricity was among the preferred methods for motor vehicle propulsion, providing a level of comfort and ease of operation that could not be achieved by the gasoline cars of the time. Modern internal combustion engines have been the dominant propulsion method for motor vehicles for almost 100 years, but electric power has remained commonplace in other vehicle types, such as trains and smaller vehicles of all types

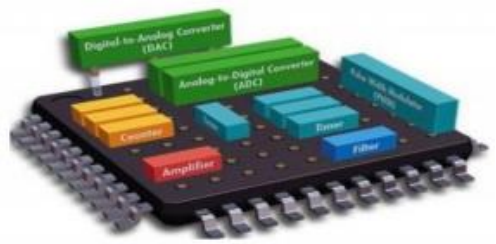


3. WHAT IS AN EMBEDDED SYSTEM ?

An embedded system isa microprocessor- or microcontroller-based system of hardware and software designed to perform dedicated functions within a larger mechanical or electrical system.An embedded system is a microcontroller-based, software driven, reliable, real-time control system, autonomous, or human or network interactive, operating on diverse physical variables and in

diverse environments and sold into a competitive and cost conscious market[6].Its purpose isto control the device and to allow a user to interact with it.

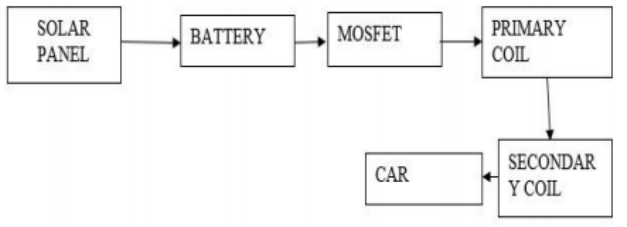
An embedded systemis not a computer system that is used primarily for processing, not a software system on PC or UNIX, not a traditional business or specific application.

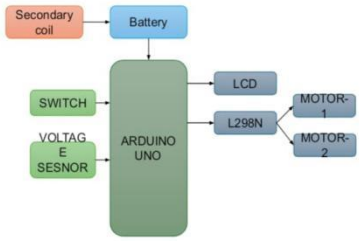


APPLICATION OF EMBEDDED SYSTEM

Embedded systems are used in different applications like automobiles, telecommunications, smart cards, missiles, satellites, computer networking and digital cons

4. BLOCKDIAGRAM





Hardware Requirements

5. HARDWARE COMPONENT

1. Atmega 328p
2. 4047 IC
3. 1N4007
4. Coil
5. LED
6. 16*2 LCD display

ATMEGA 328p

The Atmel ATmega328P is a 32K 8-bit microcontroller based on the AVR architecture. Many instructions are executed in a single clock cycle providing a throughput of almost 20 MIPS at 20MHz. The ATMEGA328-PU comes in an PDIP 28 pin package and is suitable for use on our28 pin AVR Development Board.The computer on one hand is designed to perform all the general purpose tasks on a single machine like you can use a computer to run a software to perform calculations or you can use a computer to store some multimedia file or to access internet through the browser, whereas the microcontrollers are meant to perform only the specific tasks, for e.g., switching the AC off automatically when room temperature drops to a certain defined limit and again turning it ON when temperature rises above the defined limit[10].

4047 IC

The CD 4047 IC is one kind ofmultivibratorincluding a high voltage. The operation of this IC can be done in two modes like Monostable & Astable. This IC requires an exterior resistor & capacitor to decide the output pulse width within the monostable mode & the o/p frequency within the astable mode. This IC operates at 5 Volts, 10 Volts, 15Volts & 20Volts. The 4047 IC is a CMOSmultivibrator that works in two modes like monostable & astable. The 4047 IC applications include a wide range like generation of the pulse wave, sine wave, and DC signal to AC signal conversion, etc.

IN4007

Diodes are used to convert AC into DC these are used as half wave rectifiers or full wave rectifier.Three points must be kept in mind while using any type of diode.

1. Maximum forward current capacity
2. Maximum reverse voltage capacity
3.Maximum forward voltage capacity

COIL

A circle, a series of circles, or a spiral made by coiling. 2 : a long thin piece of material that is wound into circles.

LED

LEDs are semiconductor devices. Like transistors, and other diodes, LEDs are made out of silicon. What makes an LED give off light are the small amounts of chemical impurities that are added to the silicon, such as gallium, arsenide, indium, and nitride. When current passes through the LED, it emits photons as a by product. Normal light bulbs produce light by heating a metal filament until its white hot. Because LEDs produce photons directly and not via heat, they are far more efficient than incandescent bulbs

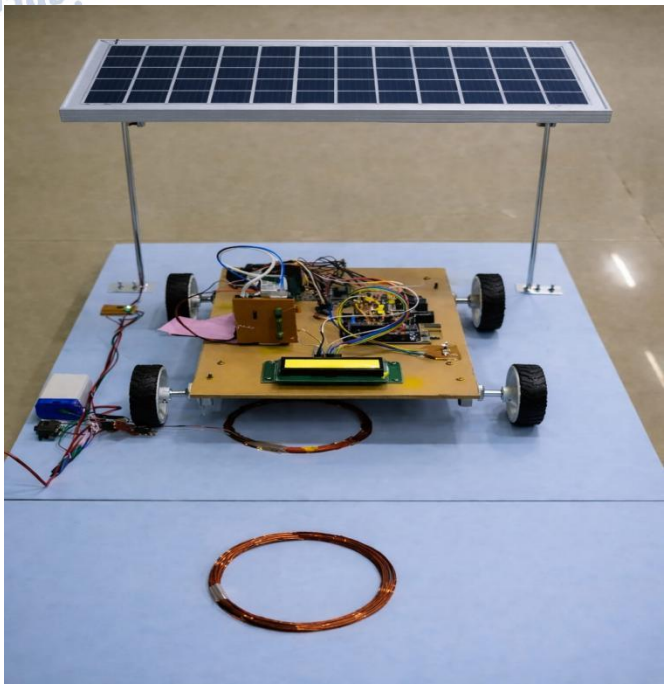
16*2 LCD

This is the example for the Parallel Port. This example doesn't use the Bi-directional feature found on newer ports, thus it should work with most, if not all Parallel Ports. It however doesn't show the use of the Status Port as an input for a 16 Character x 2 Line LCD Module to the Parallel Port[.These LCD Modules are very common these days, and are quite simple to work with, as all the logic required running them is on board

HARDWARE OUTPUTS:

The system makes use of a solar panel, battery, transformer, regulator circuitry, copper coils, AC to DC converter, atmega controller and LCD display to develop the system. The system

demonstrates how electric vehicles can be charged while moving on the road, eliminating the need to stop for charging. The solar panel is used to power the battery through a charge controller. The battery is charged and stores dc power. The DC power now needs to be converted to AC for transmission. For this purpose we here use a transformer.



The power is converted to AC using a transformer and regulated using regulator circuitry. This power is now used to power the copper coils that are used for wireless energy transmission. A copper coil is also mounted underneath the electric vehicle.

When the vehicle is driven over the coils energy is transmitted from the transmitter coil to ev coil. Please note the energy is still DC current that is induced into this coil. Now we convert this to DC again so that it can be used to charge the EV battery.

We use AC to DC conversion circuitry to convert it back to DC current. Now we also measure the input voltage using an atmega microcontroller and display this on an LCD display. Thus the system demonstrates a solar powered wireless charging system for electric vehicles that can be integrated in the road.

6. CONCLUSION

The Solar Wireless Electric Vehicle Charging System presents an innovative and sustainable solution to modern transportation energy challenges. By integrating solar energy generation with wireless power transfer technology, the system eliminates the need for conventional wired charging infrastructure, enhancing convenience, safety, and efficiency.

This project successfully demonstrates how renewable energy sources can be effectively utilized to charge electric vehicles without physical connections. The use of solar panels ensures clean energy production, while wireless charging technology provides seamless energy transfer, reducing wear and tear associated with cables and connectors.

Furthermore, the system contributes to reducing carbon emissions, supports green mobility, and aligns with future smart city developments. Although there are challenges such as efficiency losses and higher initial costs, advancements in power electronics and energy storage technologies can overcome these limitations.

In conclusion, the proposed system offers a promising step toward eco-friendly and user-friendly EV charging solutions, with significant potential for future development and large-scale implementation.

FUTURE SCOPE

The solar wireless electric vehicle charging system has significant potential for future development as the demand for sustainable and efficient transportation increases. With advancements in wireless power transfer technology, the system can be further enhanced to achieve higher efficiency and longer transmission distances, reducing energy losses during charging. In the future, dynamic wireless charging may be implemented, allowing electric vehicles to charge while in motion through embedded charging infrastructure in roads, thereby minimizing the need for frequent stops and reducing battery size requirements.

Integration with smart grid technology will enable better energy management, real-time monitoring, and optimal utilization of solar power, ensuring reliable and continuous energy supply. The incorporation of artificial intelligence and IoT can further improve system performance by enabling predictive maintenance, intelligent energy distribution, and automated control of charging processes. Additionally, the expansion of this system into smart cities will support large-scale adoption, where public places such as parking areas, highways, and commercial centers are equipped with wireless charging facilities.

Conflict of interest statement

Authors declare that they do not have any conflict of interest.

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