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Solar Based Wireless Electric Vehicle Charging Station for Authorised Person

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Abstract: *This research paper proposes solar wireless electric vehicle charging system Electric vehicles (EVs) have recently improved in terms of performance and range. There are many models on the market, and the number of electric cars on the road is growing rapidly. While current EVs are mostly charged via wires, companies like Tesla, BMW and Nissan have started developing wireless charging EVs that don't require large wires. The wireless connection (inductive) is not a physical connection, but effectively avoids the consequences of plugging and unplugging. In addition, wireless charging opens up new possibilities for dynamic charging - charging while driving. When implemented, the driving power of the electric car will not be limited and the need for battery capacity will be minimized. This was the first and it spread all over the world, mainly in England, Germany and South Korea. This article provides an informative review of wireless charging technologies for electric vehicles. Describes and compares the main techniques of wireless charging such as charging topologies, coil design and communication. New ways to use superconducting materials in coil construction to charge more energy are explored and their effects on wireless charging are discussed. Additionally, health and safety issues related to wireless payment and related systems are covered. Economically, the costs of various wireless charging systems are also noted and compared.*

Keywords: Embedded system, Rechargeable Battery, Transformer, Electric Vehicle, Solar Energy, Wireless Power Transmission

I. INTRODUCTION

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. The system makes use of a solar panel, battery, transformer, regulator circuitry, copper coils, AC to DC converter, PIC micro controller and LCD display to develop the system. The system demonstrates how electric vehicles can be charged while moving on 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 transformer and the 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 anPIC micro controller microcontroller and display this on an LCD display. Thus the system demonstrates a solar powered wireless charging system for electric vehicle that can be integrated in the road.

Need of Project:

The motivation for this research paper is to tackle two main issues 1) Long charging time - takes 1-3 hours to charge. 2) Electric charging stations outside the city and in remote areas where there is no electricity. Here we have created an EV

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charging system that solves both of these problems with a unique and innovative solution. Here we have created an EV charger that solves two problems with a unique solution.

Objective:
This electric car has the following advantages:

- Wireless charging of the vehicle
- No need to stop for charging, charges while the vehicle is walking
- Charges by solar energy
- No external electricity required
- Coils are inserted way to avoid wear and tear

II. LITERATURE SURVEY

[1] Solar Wireless Electric Vehicle Charging System
Author: BRV Prasad, M Geethanjali, M Sonia, S Ganeesh
This paper 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,

[2] Solar Wireless Electric Vehicle Charging System
Author: Karim, Merazul Shafiq, Nahian Bin Zame, Tousif-ul Islam Hossain, MD. Sakib Shawon, Mehedi Azad
The number of countries with electric vehicles on the road is steadily rising. In addition to helping the environment, electric vehicles have proven useful in cutting down on transportation costs by substituting expensive fuel with much more affordable power. Here, we create a novel and effective answer to this problem by designing an electric vehicle charging infrastructure. There is no need to stop for charging because the EV can do so while it is in motion; the system is powered by solar energy; and there is no need for an additional power source.

[3]Wireless charging systems for electric vehicles
Author: Muhammad Amjad , Muhammad Faroo q-i-Azam
Electric vehicles require fast, economical and reliable charging systems for efficient performance. Wireless charging systems remove the hassle to plug in the device to be charged when compared with the conventional wired charging systems. Moreover, wireless charging is considered to be environment and user friendly as the wires and mechanical connectors and related infrastructure are not required. This paper reviews the methods and techniques used for wireless charging in electric vehicles. First, the general techniques for wireless power transfer are described and explained.

[4] An Overview of Solar-Powered Electric Vehicle Charging in Vehicular Adhoc Network
Author: Farooque Azam, Neeraj Priyadarshi, Haris h Nagar, Sunil Kumar & Akash Kumar Bhoi
With the rise of EVs, the demand of charging has necessitated the inclusion of renewable energy sources to supplement the grid. Intelligent transportation system (ITS) provides safety and comfort to the connected vehicle. Design of charging strategy to obtain optimal energy utilization poses the challenge to the researchers when both electric vehicle (EV) and charging stations are considered together in vehicular ad hoc network (VANET). Here, we first introduce the VANET environment in which the communication between EVs on the road, road side unit (RSU), and a traffic server takes place. Then, the overview of solar PV integration with grid to meet the demand in peak hour has been discussed.

III. METHOD OF DISEASE DETECTION

This block diagram represents a system powered by both solar energy and a transformer, managed by a PIC18F4520 microcontroller. The solar panel generates DC power, which is converted to a suitable voltage by a DC-to-DC converter and stored in a battery bank. Simultaneously, AC power from the transformer is converted to DC by an AC-to-DC converter and also charges the battery bank. The PIC16f886 microcontroller acts as the central control unit, monitoring and managing various aspects of the system. It receives inputs from sensors like an RFID reader, AC voltage sensor, battery voltage sensor, solar voltage sensor, and switches. Based on these inputs, the microcontroller controls various outputs. It drives an LCD display to show system information, activates a buzzer through a relay driver circuit for alerts, and controls wireless charging via another relay driver circuit. It also drives red and green LEDs for visual indications. Overall, the system intelligently manages power sources, monitors vital parameters, and provides user feedback and control through the microcontroller.

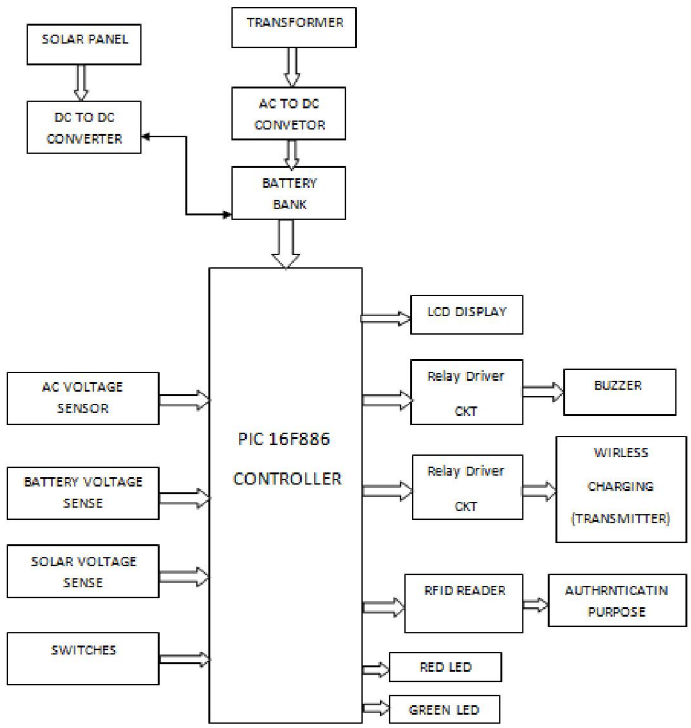

Fig. 1. Block Diagram (Charging Unit)

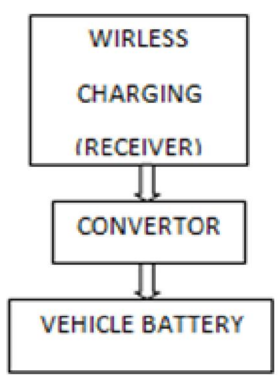

Fig. 2. Block Diagram (Vehicle unit)

The main component of this system is the various ways of stepping down the incoming voltage. A conventional 220Vrms/50 Hz means is stepped down using the transformer to our required voltage and then converted to DC voltage. By using an inverter, the DC is converted to AC of our desired high frequency. The power is then transmitted through the transmitter coil to the receiver coil through inductive coupling. The receiver coil is placed at a particular distance and AC power is delivered at the end. This power is then rectified and regulated using a bridge rectifier and Zener diode circuit. Afterwards, the energy is harnessed to charge the battery. The transmitter and the receiver coils were designed to achieve maximum quality factor to maximize power transfer at the frequency of operation.

AC main from the grid is converted into high frequency AC through AC/DC and DC/AC converters to enable power transfer from transmission coil to the receiving coil. Series and parallel combinations-based compensation topology are used in both receiving and transmitting sides to improve the overall system efficiency [6]. Receiving coils are fixed under the vehicle to convert the oscillating magnetic field to high frequency AC. The high frequency AC is converted into a stable DC supply which can be used by the on-board batteries. To avoid any kind of health and safety issues and stable operation the power control, communications, and battery management system (BMS) are used. To reduce any harmful leakage fluxes and to improve magnetic flux distribution, magnetic planar ferrite plates are used at both transmitter and receiver sides.

PIC16F886 Microcontroller

The PIC16F886 features 256 bytes of EEPROM data memory, self-programming, an ICD, 2 Comparators, 11 channels of 10-bit Analog-to-Digital (A/D) converter, 1 capture/compare/PWM and 1 Enhanced capture/compare/PWM functions, a synchronous serial port that can be configured as either 3-wire Serial Peripheral Interface (SPI™) or the 2-wire Inter-Integrated Circuit (I²C™) bus and an Enhanced Universal Asynchronous Receiver Transmitter (EUSART). All of these features make it ideal for more advanced level A/D applications in automotive, industrial, appliances or consumer applications.

Special PIC16f886 Micro controller Features

- Power-Saving Sleep mode
- Power-on Reset (POR)
- Selectable Brown-out Reset (BOR) voltage
- Extended Watchdog Timer (WDT) with its own on-chip RC oscillator for reliable operation
- In - Circuit Serial Programming™ (ICSP™) via two pins
- In - Circuit Debug (ICD) via two pins
- High - endurance Flash/EEPROM cell:

Fig. 3. PIC16f886

Wireless Power Transmission coil

The Wireless Power Transfer and Charging Module can be used in electronic equipment's in common use for close wireless charging or power supply. Consist of a Transmitter & Receiver and coil, it could serve as a replacement for the

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Wireless Power Supply with stable 5V output voltage and maximum 600mA output current. Its small size and insulation coil is more suitable for using in wireless project.This module uses an electromagnetic field to transfer electric energy between a transmitter circuit and a receiver circuit. An induction coil creates an alternating electromagnetic field from within the transmitter circuit powered with 12V. The second induction coil takes power from the electromagnetic field and converts it back into electrical current to the receiver circuit that outputs 5V - 600mA.

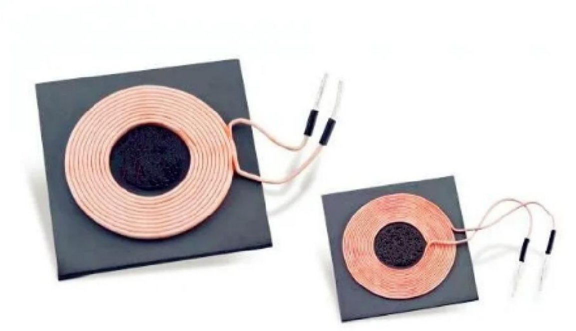

Fig. 4.Wireless Power Transmission Coils

Voltage Sensor

A voltage divider circuit is a simple and common way to create a voltage sensor. It's a passive linear circuit that produces an output voltage that's a fraction of its input voltage. Here's how it works:

Basic Principle:

A voltage divider consists of two resistors (or impedances) connected in series.

When a voltage is applied across the series combination, the voltage is divided between the resistors in proportion to their resistances.

By measuring the voltage across one of the resistors, you can determine the input voltage.

The Formula:

If you have two resistors, R1 and R2, in series, and an input voltage Vin, the output voltage Vout across R2 is given by:

Vout = Vin * (R2 / (R1 + R2).

LCD Display

A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data.The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD.

Fig. 5.LCD Display

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RFID Tag Reader

It is used to read unique ID from RFID tags. Whenever RFID tags comes in range, RFID reader reads its unique ID and transmits it serially to the microcontroller or PC. RFID reader has transceiver and an antenna mounted on it. It is mostly fixed in stationary position.

RFID Tag:RFID tag includes microchip with radio antenna mounted on substrate which carries 12 Byte unique Identification number.

Fig. 6.RFID Tag Reader

IV. RESULT

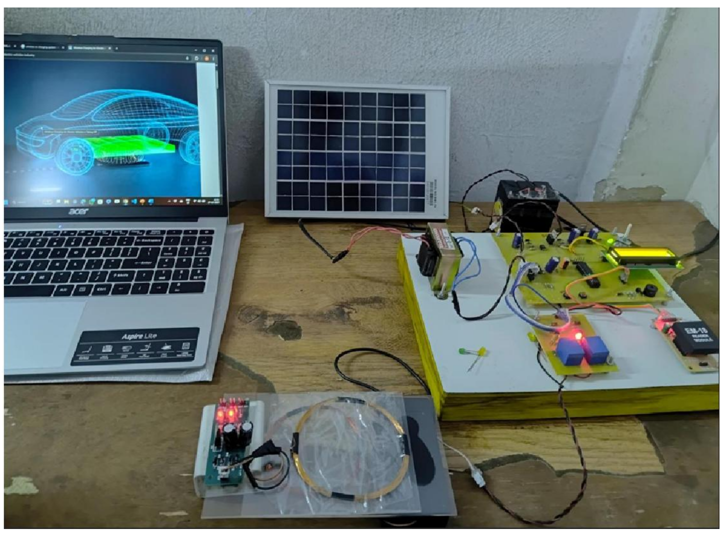

Fig. 7.Photograph of Project Model

Power is converted to AC using a transformer and controlled using an electronic regulator. Electric current is used to power the copper used for wireless transmission. A copper coil is also placed under the EV. When the car is driven on the steering wheel, the power is transferred from the transmission to the electric steering wheel. Note that the power is still the DC current induced in this coil. Now we change it back to direct current to charge the electric car batteries

The solar wireless charging system for electric vehicles showcases impressive efficiency, boasting charging rates between 88% and 93%. This rivals traditional plug-in methods while offering the added convenience of wireless charging. Its ability to charge EVs while in motion eliminates frequent stops at charging stations, significantly extending their range and usability. By integrating solar power, the system further enhances sustainability, reducing reliance on conventional energy sources and offering cost savings through the utilization of cheaper electricity. Overall, this system marks a significant leap forward in electric vehicle infrastructure, promising a greener, more efficient, and sustainable future for transportation.

V. CONCLUSION

The movement of automobile sector from conventional fossil fuelled vehicles to Electric vehicles are drastically increased. There is a requirement for more electric vehicles charging station in the roadsides of highways in regular intervals like the petrol pumps now. This electric charging increases the needs of more electricity. If the demand of electricity increases the respective department want to produce more electricity by hydro-power plant, thermal plants, etc. The use of fossil fuels also leads to environmental pollution. So we need a grid connected solar powered electric vehicle charging station. This can reduce the cost of battery for store charge in day time and provide charge for charging in night time, the efficiency of battery is also small. So by eliminating batteries we can improve the performance.

In conclusion, the Solar Wireless Electric Vehicle Charging System presents a transformative solution at the intersection of sustainability and technology. By harnessing solar energy and wireless transmission, it offers an efficient and convenient charging method for electric vehicles. With its Arduino-based control and monitoring capabilities, coupled with energy storage using 18650 batteries, this system not only reduces reliance on fossil fuels but also enhances user experience and accessibility. As we strive towards a greener future, innovations like these pave the way for more sustainable transportation solutions.

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