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Original Article

Solar Powered Wireless Charging Station for EV

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Abstract: *The rapidly changing industry moves from IC engine vehicles to EV's. India's government intends to have only electric vehicles by 2030. Large scale of charging infrastructure is required to make EVs widely accepted, as charging time is the primary obstacle to EV adoption. With the widespread use of electric vehicles, the current power supply may experience significant instability. The "SOLAR POWERED WIRELESS CHARGING STATION FOR EV" project uses power from renewable energy source rather than conventional grid power. Solar energy is converted to electrical energy, which is then stored in a lithium-ion battery storage unit. A wireless charging system will be established with the storage battery unit. This stored energy is utilized to charge EV's through wireless power transmission. The whole process is automated through use of RFID technology in relation with arduino uno processors thereby eliminating any manual interruption for charging of the Electric vehicle.*

Keywords: *Solar Power, Arduino Uno, Electric Vehicle. RFID Technology.*

I. INTRODUCTION

India is witnessing a rapid urban growth trajectory with a projected increase of urban population from 340 million in 2008 to 590 million by 2030. Consequently, efficient ways to manage complexities, increase efficiency and improve the quality of life are required to accommodate this rapid urbanisation and make cities sustainable. Clean and reliable energy has been regarded as a key parameter for sustainable urban growth. Despite the government's endeavour to transition to a cleaner energy source, penetration of renewable energy source in urban areas remain low. Further, the growing urban regions also demand an improved and extensive transport network to connect different areas. This increased vehicular stock further puts pressure on the environment. The government is taking initiatives for the introduction and manufacture of full range of electric vehicles, to tackle pollution. Sadly, the lack of EV charging infrastructure dissuades many buyers.

In order to mitigate the above challenges extensive application of renewable energy in urban area which provide a clean form of energy for present and future EVs on the road. Furthermore, these future cars would be requiring a storage battery as a space to store the produced energy in order to go a considerable distance. When compared to gasoline (approximately 12,000 Wh/kg), Li-ion batteries, have an energy concentration of just 89-110 Wh/kg. . As a result, lithium-ion battery-powered electric vehicles can only run about 300 miles before recharging the battery.

Aside from the low energy concentration, modern battery equipment have the disadvantages of a long recharging phase, a bulky size and load, a short lifespan, and a high price. Alternative charging solutions based on renewable energy sources and highways must be designed to eliminate these obstacles.

II. EXISTING METHODOLOGY

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 [15].

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 [16].

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[17]. Thus the system demonstrates a solar powered wireless charging system for electric vehicles that can be integrated in the road.

III. PROPOSED METHODOLOGY

The proposed system is designed to implement automated charging station for electric vehicles to charge wirelessly by wireless power transmission principle. The system also includes NFC/RFID technology to interpret customer identification and automation of the charging process. The arduino uno processor acts as a crucial part in the proposed system. The processors compile the user data from RFID reader and switch the relay after check statement.

Components used:

- Arduino uno.
- Solar panel.
- Lithium-ion battery.
- 5v relay.
- Transmitter and receiver coils.
- LCD display.
- RFID reader and card.
- Voltage sensor.
- DC to AC Inverter.
- AC to DC rectifier.

A. Block Diagram

Figure 1: Block diagram of Transmitter Block

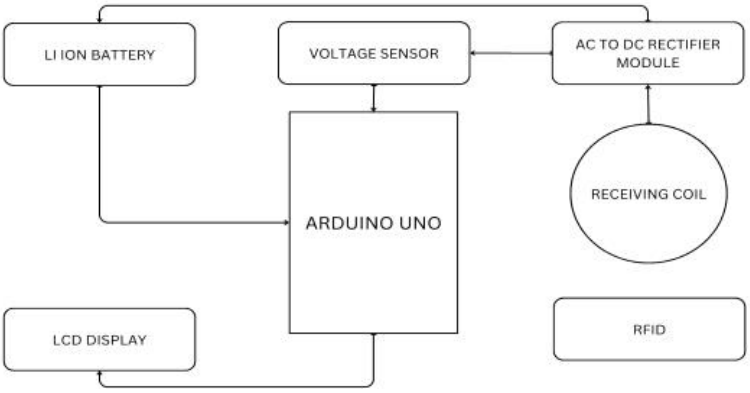

Figure 2: Block diagram of Receiver Block

Block diagram consists of Arduino controller, LCD display, LED battery, solar panel, transmitting and receiving coils, relay, high frequency inverter and rectifier etc. Primary coil is fixed at transmitting module where the solar panel is used as source. Secondary coil is fixed at the base of car. Whole setup works on the basis of wireless power transmission (WPT)

Concept. LED will glow when energy is transferred from primary coil to secondary coil. The LCD display on the transmitting module displays the vehicle data and the charging status after RFID tags are identified. The LCD display on the vehicle displays charging status and real time charging voltage. The voltage sensor on receiving module measures the voltage at the receiving coil in real time values. The relay on the transmitting module only closes when the signal from arduino is received soon after processing the customer data from RFID reader.

IV. WORKING DESCRIPTION

- The power from the solar panels are enhanced and stored in the li-ion battery unit in the charging station.
- The system runs as standalone station sourced only from solar panel units.
- The charging station has its own BMS and has arduino processor which is integrated with an RFID reader toread and check the user data.
- The arduino switch signal the relay after status checking the user ID by RFID reader whenever an EVapproaches the charging station.
- The DC to AC converter output is sent to the transmission coil through relay.
- The receiver coil in the EV will be aligned with the transmission coil placed in the floor of the charging station ifparked in the appropriate space for the vehicle.
- The receiver coil output is sent to the battery for charging through rectifier unit and voltage sensors which are connected parallel.
- The voltage sensor output is displayed through LCD display, which shows real time voltage values.
- The charging station displays the vehicle data through an LCD display.

V. CONCLUSION

The report offered an inventive keen charging framework for future electric vehicles. It is an imaginative (on the grounds that it is an enlistment loop free) remote charging component that rehearses sun based boards. To minimize fossil fuel by-product, from public vehicle perspectives, it is alluring to track down a substitute wellspring of energy. Electric vehicles can be the method of lessening fossil fuel by-products without consuming petrol. To help the charging arrangement of electric vehicles all the more creatively, easy to use, and with no trouble, a remote charging framework can be an exceptionally viable arrangement. The re-enactment results show non-radiative remote force is communicated through the air hole at full recurrence coordinating.

The existing charging framework can be easily integrated with this system, although a large initial investment is required. The solar-powered charging station might well be built at a lower cost with such a higher energy yield while removing the existing infrastructure. Because old charging infrastructures are supposed to be maintained, the circle of sun-oriented placement could run smoothly. The replacement of air terminals and parking lots is subject to changing schedules. When financial problems become the primary motivating factor for just a state or city's budget, the option of solar streets should be made available and protected.

This new, remote charging strategy for electric vehicles, whenever received, will be a way to the significant lessening in CO_2 outflows. Relating with a gas controlled vehicle, carbon dioxide emanation is lessened in EVs from 60 to 30 metric huge loads of discharge, which implies a half decrease. This will assist with decreasing environmental change, and help bring a noble change in the nature.

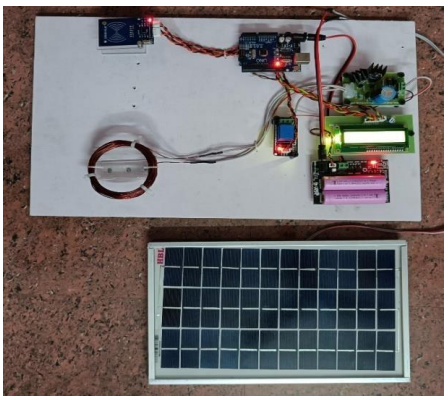

Figure 3: Transmitter Station

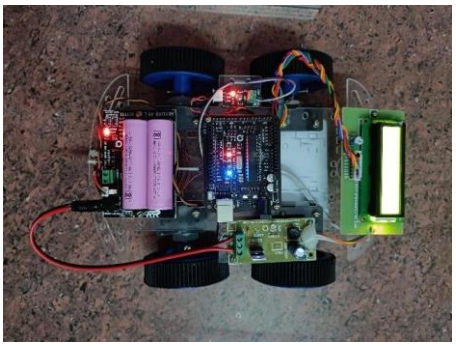

Figure 4: EV Receiver

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