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WIRELESS POWER CHARGING AND HYBRID POWER GENERATION FOR ELECTRIC VEHICLE

A. Mary Beula*, P. Aadhavan, A. Priyanka**, H. Rifaaideen** & A. Sathishkumar****

* Assistant Professor, Department of Electrical and Electronics Engineering, M.A.M College of Engineering and Technology, Siruganur, Trichy, Tamilnadu

** UG Student, Department of Electrical and Electronics Engineering, M.A.M College of Engineering and Technology, Siruganur, Trichy, Tamilnadu

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Abstract:

Usage of non-renewable sources for charging purpose meets with some risk factors and also cost effective. In order to resolve the above issues make use of renewable energy sources like solar and wind energy for charging the battery. The paper specially presents an evaluation on how the future EV development and wireless charging methods can be implemented. In this manuscript develop a solar energy, wind energy and Wireless Power Transmission (WPT) for charging the vehicle, is thus an approach to noiseless, cost efficient and convenient charging. Wireless power transmission (WPT) is popular and gaining technology finding its application in various fields. Also measuring battery management and update in the IOT app/webpage.

Key Words: Energy Management, Electric Vehicle, Solar Energy, Microgrid.

Introduction:

WPT technology has numerous inherent advantages over conventional means of power transfer, thus has received much attention in the past decade. Magnetic WPT systems rely on magnetic field coupling to transfer electric power between two or more magnetically coupled coils across relatively large air gap. Now a day's electrical energy is generated by the conventional energy resources like coal, diesel, and nuclear etc. The main drawback of these sources is that it produces waste like ash in coal power plant, nuclear waste in nuclear power plant and taking care of this wastage is very costly. And it also damages the nature. In order to overcome this issue we implement the renewable energies like solar and wind energies.

The increasing global warming has caused awareness among the people to switch to electric vehicles. The time required to wait at charging stations while the battery is being charged will be reduced by a considerable amount of time when the charging will be done on road while driving the vehicle. Even though electric vehicles are an alternative, there needs to be development in its charging system to make it the prime option for transport. For this purpose, the charging systems should be developed. Dynamic charging systems are more reliable, user friendly and time efficient. Also, the battery size can be reduced, and the range can be improved. This charging system can also be implemented in the travel routes, traffic signals, bus stations.

Interest in electric vehicles (EVs) has recently grown due to calls for eco friendly transportation. Battery-powered electric buses or plug-in EV buses, which produce zero tailpipe emissions, offer significant potential in improving sustainability and an eco friendly environment in urban areas. EV-based transit buses require a large battery for a long service time. For instance, a long-range all-electric bus manufactured by BYD Auto Company has a 324-kWh lithium iron phosphate (LFP) battery. Unfortunately, the large capacity of the batteries of current EV buses prevents them from gaining popularity as a mainstream mass transit solution. The current problems of plug-in EV buses are the long operational idle during the battery charging time, the high cost of the battery, and the great weight of the battery. Dynamic wireless charging (DWC) systems have emerged as an alternative to address the challenges caused by the current battery technology. However, inductive charging requires that the secondary, receiver, coil has to be precisely positioned above the primary, transmitter, coil in order to achieve a high power transfer and efficiency. Thus, new solutions that can help the driver position the car sufficiently accurately for inductive charging are needed.

On implementing the Wireless inductive charging of electric vehicles could potentially change user behavior from "going somewhere to refuel" to "recharge whenever parked", thus giving electric vehicles yet another competitive advantage over fossil-driven vehicles therein users rarely or ne'er ought to suppose provision. It is also used to achieve a high power transfer and efficiency.

In the study, the users found this to be a hard task, especially since the charging equipment was mounted at the rear of the vehicles and even more so when victimization public parking areas, despite the accessible guiding support. From a user perspective, the parking downside might be compared with the problems many folks expertise nowadays once driving into a automotive wash. Thus, new solutions that can help the driver position the car sufficiently accurately for inductive charging are needed.. Thus, new solutions that can help the driver position the car sufficiently accurately for inductive charging are needed.

In this project, we develop a digitized car parking and charging unit which can be used and it is monitored using IOT. And also WPT attempts minimize the fuel losses along with reduction in pollution levels caused due to the resources used presently.

Fundamental Circuit:

The figure 1 shows the block diagram of the proposed circuit. The AC source voltage is stepped down using a transformer and converted to DC using a rectifier circuit. This voltage is then converted to AC voltage of the required frequency using an inverter. The voltage of desired frequency is fed to the transmitter coil of the system which is mounted on the base unit. In case of dynamic wireless charging this base unit will be mounted on the road. The receiver unit will be mounted on the base of the car. Power is transmitted from transmitter coil to receiver coil through inductive coupling. The power is then rectified and regulated to suit the battery specifications. Thus the charging of the battery will take place..

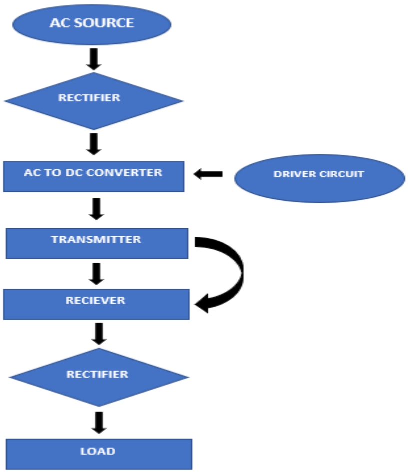

Figure 1: Block Diagram of working of wireless charger

Implementation of Wireless Charging:

Wireless charging is useful in eliminating the need of conductive wires and thus conduction losses which can take place through wire can be completely cut out. Also the human handling of wires during the charging process for plug in and plug out can sometimes be hazardous if not done correctly. Thus the human intervention can be avoided for safety purposes. Even though wireless charging seems to be time saving and effective, it comes with certain limitations. The main aspect of implementation is the development in infrastructure which needs to be done to suit the purpose. This will require a huge investment of capital during all stages of the work and hence it is a costly affair. The first wireless charging technology to be developed was stationary, the system having been designed to charge EVs in garages or public parking spaces, when the vehicle is not operating for an extended period. Because a physical connection is not required, there has been major interest in the possibility of charging EVs while they are in transit. Charging an EV while in motion is called dynamic wireless charging.

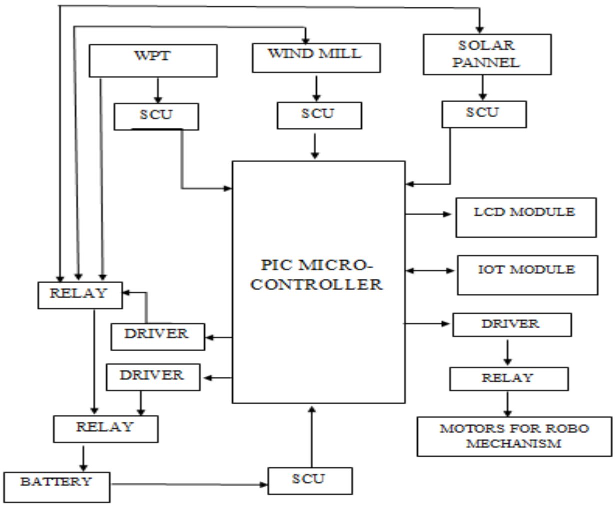

Figure 2: Block Diagram of Proposed System

Battery in our E-vehicle will be charged automatically using power obtained from the solar panel, wind energy and wireless power transmission kit. This project proposes a new analysis concept for power flow in WPT The tuned primary and secondary provides a frequency selection. It resemblance to power transmission network having reactive power voltage control. It provides dynamic wireless charging, charging while the vehicle is moving. In our project we use iot app/webpage to monitor the E-vehicle parameters. Through cayenne mobile app we can able to monitor the battery capacity , solar panel voltage and wind power voltage from the E-vehicle. Battery voltage will be continuously monitored and displayed in the LCD and updated in the IOT app.

Static Wireless Electric Vehicle:

Static WEVCS (Wireless Electric Vehicle Charging System) can easily replace the plug-in charger with minimal driver participation, and it solves associated safety issues such as trip hazards and electric shock. Figure 2 shows the basic arrangement of static WEVCS. The receiving energy is converted from AC to DC using the power converter and is transferred to the battery bank. In order to avoid any safety issues, power control and battery management systems are fitted with a wireless communication network to receive any feedback from the primary side. The charging time depends on the source power level, charging pad sizes, and air-gap distance between the two windings. The average distance between lightweight duty vehicles is approximately 150–300 mm. Static WEVCS can be installed in parking areas, car parks, homes, commercial buildings, shopping centres, and park ‘n’ ride facilities.

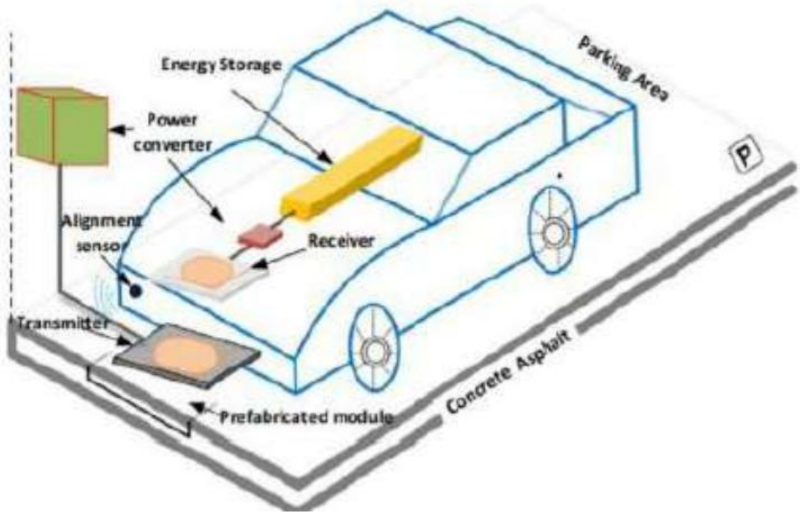

Figure 3: Static Wireless ev Charging

Dynamic Wireless Charging System [DWCS]:

As the name suggests Dynamic wireless charging system is the system in which EV is charged while it's in motion. The main concern for electric vehicle deployment is the power and range. For improving the range of the vehicle dynamic wireless charging will be beneficial. The DWCS is also termed as “on road charging”. If the charging is done at proper intervals a large capacity battery is not required and this makes the vehicle lighter and more economical.

DWCS provides a better option for the charging of electrical vehicles to improve its range. The base unit will be placed below the roads on predefined routes and the car will have the battery bank. The car will pass over the road and charging will be done when the car is in motion. This will require a lot of investment and infrastructure modification at the initial stages but slowly the system will help in gaining market for electric vehicles making a better option over conventional means of transport. Wireless power transfer is the latest technique to charge/discharge the EVs without any physical contact between source and load. WPT transfers electrical energy through electromagnetics. There are several advantages of WPT, such as:

- The physical connection requirement is avoided, which leads to less fault in charging equipment. Also, it helps to start the charging using the software interface (mobile phone, tablet, in-vehicle application).
- The charging equipment is installed under the ground, which helps to facilitate higher numbers of EV charging simultaneously in the same size station. In addition, charging equipment is protected from environmental hazards.

In the United States, many wind and solar power plants are built along the highways, in which the dynamic WPT technology can be integrated with renewable energy In the United States, many wind and solar power plants are built along the highways, in which the dynamic WPT technology can be integrated with renewable energy

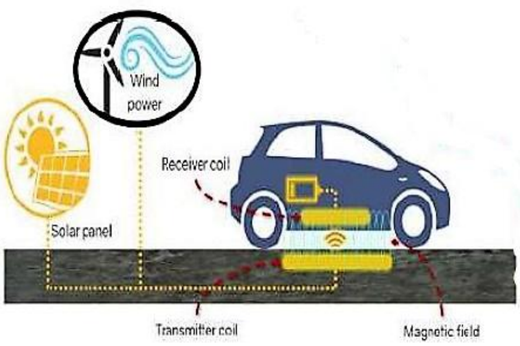

Figure 4: Dynamic Wireless Charging System

EV Charging from Wind Energy:

Wind power is typically generated today using onshore or offshore wind farms that are located far away from charging electric vehicles. This means that the power must be carried over a long distance between the supply and the EV load. A wind turbine is typically rated on the order of megawatts whereas an EV charger is normally operating on the order of kilowatts. This reflects the large difference in the power scale and the capacity of a wind turbine to charge several hundred cars. Wind generation is ideally suited for charging electric cars at homes at night. Hence wind generations are ideally suited for charging electric cars at home at night.

EV Charging from Solar Energy:

The advantage of solar panels is that apart from being installed as a solar farm, they can also be installed on the roofs of buildings. Therefore, solar power can be generated close to where electric vehicles will be charged, thus reducing transmission losses. Rooftop solar PV systems are typically rated in the order of kilowatts which is similar to the power rating of an EV charger. In contrast to wind generation, solar generation is maximum in the daytime and summer. Hence, solar generation is ideally suited for charging cars at workplaces during the day.

Power Converters for Charging E-Vehicle:

The generators used in wind turbines usually produce variable frequency AC electricity. Two back-to-back AC-to-DC and DC-to-AC power converters used to convert variable frequency AC power to high voltage or medium voltage 50 Hz or 60 Hz AC power for long-distance power transmission are done. This power is then moved to low voltage AC power, and the EV can then be charged using either AC or DC charging. The simplest way to realize a solar-powered EV charging station is to use a solar inverter. The DC-to-DC power converter operates the solar panels at maximum Power Point. Then, the DC-AC inverter converts the DC power into 50 Hz or 60 Hz AC power for AC charging of the EV. However, there is a disadvantage to this method. Both photovoltaic panels and EV batteries are direct current or DC in nature. And in this method, DC power is inexplicably converted to AC and back. Therefore, a more efficient way to charge an EV from a PV is to use an isolated DC-to-DC converter and directly charge an EV from a PV using DC charging as shown in the figure.

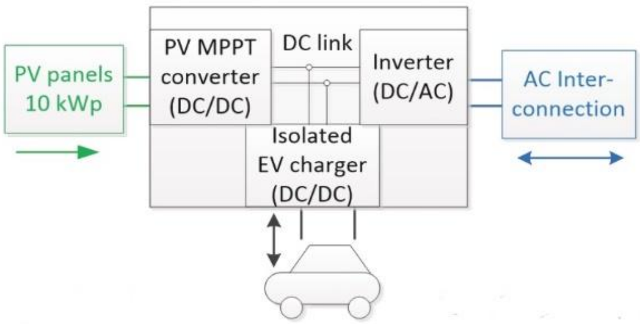

Figure 5: Power Converters for E-Vehicle

Merits and Demerits of Wireless:

Merits:

- Environment-Friendly – The biggest and the best reason to use an electric vehicle is that it is environment friendly. They do not release vicious gases that lead to air pollution as against the fossil fuel powered cars.

- No Fuel or Gas Cost – Since electric vehicles need no fuel or gas to power them, a user can escape the steep rise in prices of these commodities. All it needs is to be plugged in and ready to go another 100 miles.
- More convenient – The electric vehicle is easy to recharge. You will no longer need to run the fuel station to get your car recharged before hitting the road! Even a regular household socket could be used for charging an electric car.
- Quieter – Electric cars cut noise pollution as they have fewer moving parts than a conventional vehicle. They are much quieter when in operation. An electric car is very quiet and very smooth compared to a petroleum-powered internal combustion engine vehicle.

Demerits:

- Lack of Charging Stations – One of the major advantages of using an EV is the fact that it does not need any petrol or diesel to run. Instead, it just needs a charging station where the vehicle can be plugged and ready to go. However, one of the major challenges that are hindering its adoption is the lack of a sufficient number of charging stations. For example, India has very few EV charging stations. Even if you buy an EV, it will make no sense unless there is a charging station in your vicinity. For promoting an increased adoption of these vehicles, it is first necessary to build an adequate number of charging stations.
- Expensive – Buying an electric vehicle is still expensive. There are many fossil fuel cars available in the market at different price points. However, electric vehicles offer lesser options to choose from, and the better ones are highly priced. It is absolutely necessary for governments to promote the usage of EVs through subsidies and incentives – both to buyers and manufacturers. Even the batteries that are used are still costly, though their prices are estimated to drop in near future.
- Lack of Power and Reduced Range – Fossil fuel based cars offer better acceleration when compared to electric vehicles. Though Tesla and Volkswagen are making EVs with better range, an average electric car can easily run at 100 miles to 200 miles per charge. Hence people are still skeptical about using electric vehicles for long journeys/ highway drives.
- Minimal Amount of Pollution – Electric vehicles are not 100% emission free. Even they cause a little amount of pollution indirectly. The batteries and electricity used for charging are not necessarily generated from renewable energy sources.

Implementation of Proposed System:

The automotive parking is managed by microcontroller arduino UNO and charging of power within the automotive is calculated mechanically by microcontroller and hosted in IOT cloud...Driver can even transfer WPT devices area unit used for charging vehicles.IR detector is employed to notice the vehicles parking status. The wireless charging could be attractive compared with manual conductive charging and thus, in this proposed system the inductive charging requires that the secondary, receiver, coil has to be precisely positioned above the primary, transmitter, coil in order to achieve a high power transfer and efficiency. Thus Figure 6.1 shows the automotive aspect receives the electric power to store energy at intervals of the battery. The Microcontroller arduino UNO calculates the electric power consumed via the voltage device thus showing the worth then sent to IOT cloud. If the number is paid then the Bluetooth module that is interfaced with the microcontroller sends the message to parking slots to undo the automotive.

Hardware Requirements:

Node MCU:

The Node MCU is an open source platform which includes firmware which runs on the ESP8266 and it runs on a 12 pin ESP module

Arduino UNO:

The Arduino Uno is a sixteen MHz ceramic resonator, a USB affiliation, Associate in Nursing influence jack, Associate in Nursing ICSP header, and a button.

IR Sensor:

Infrared technology addresses a good sort of wireless application the frequency range of infrared is above microwave and lesser than light. For optical sensing and optical communication, photo optics technologies are utilized in the near infrared region because the light is a smaller amount complex than RF when implemented as source of signal. Optical wireless communication is completed with IR data transmission for brief range applications. An infrared sensor emits and/or detects infrared to sense its surroundings.

Relay:

The relays are very useful devices and permit one circuit to modify another one while they're completely separate. They often want to interface an electronic circuit (working at a coffee voltage) to a circuit which works at very high voltage. For example, a relay can make a 5V DC battery circuit to modify a 230V AC mains circuit. Thus a little sensor circuit can drive, say, a lover or an electrical bulb. A relay switch is often divided into two parts: input and output. The input section features a coil which generates magnetic flux when a little voltage from an electronic circuit is applied thereto. This voltage is called the operating voltage.

Commonly used relays are available in several configurations of operating voltages like 6V, 9V, 12V, 24V etc. The output section consists of contactors which connect or disconnect mechanically. In a basic relay there are three contactors: normally open (NO), normally closed (NC) and customary (COM).When the operating voltage is applied the relay coil gets energized and therefore the COM changes contact to NO. By using a proper combination of contactors, the circuits are often switched on and off.

Arduino IDE:

The Arduino Software (IDE) contains buttons for the common functions and a series of menu functions. It connects to the Arduino and Genuino hardware to upload programs and communicate among them.

Future Scope:

Based on the policy guidance and technologies that spring up. This section is supposed to envision the future WEVC Nowadays, global EV inventories are expanding vigorously. Under the trend of industrial prosperity, two potential orientations in WEVC consist of how to guarantee a sustainable growth of EV ownership and how to allow full play of scalable development of EVs. Moreover, arising new technologies, materials and theories could make WEVC even more competitive. Power electronic devices can benefit from advanced materials as well. For one thing, besides flux leakage, switching loss is another major source of energy waste in a WEVC system. Dispensed with manual operation, static WEVC can liberate the operators' hands but fails to make charging sites more flexible. In this context, dynamic WEVC shows its unique advantage. This technology could be roughly divided into tram-based and on-road type.

Conclusion:

With the advancement of EV technology, charging infrastructure and grid integration facilities, EV popularity is expected to increase significantly in the next decade. In this context, wireless charging has aroused wide attention since it is spark-free, independent of environment and applicable to unmanned operation. This paper has outlined a comprehensive overview of wireless charging technology for EVs. This paper has outlined a comprehensive overview of wireless charging technology for EVs.WPT technology offers the possibilities for better energy performance, lower environmental impacts, lower life cycle cost, and more convenience and operational safety benefits.

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