An alternative approach for Dynamic Wireless Charging

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ABSTRACT

Today, there is a growing tendency in automotive engineering to use electric vehicles instead of traditional ones. Despite the enormous transformation that is now underway, there are still a number of issues with electrical automobiles, including the charging arrangement, charging time, and vehicle range. For the charging setup, a certain and distinct connector as well as a space are required. The wireless power transmission technique utilized in this research uses magnetic induction. Battery size may be reduced while efficiency and range are increased with the help of this technology. The efficiency of the earlier method is decreased when only one coil is used for transmission and reception. This has to be changed to achieve improved efficiency, which has been achieved in the proposed approach by utilizing technologies often seen in electric trains, A change in the coil design has given us a significantly higher efficiency.

Keyword : *wireless power transfer, quad coil, pantograph, electric vehicle*

1. INTRODUCTION

In the realm of the automobile industry, the notion of an electric vehicle (EV) is a relatively recent one. Although some automakers have built their whole line of vehicles on utilizing energy and being proactive, several also provide hybrid cars that run on both gas and electricity. A fantastic approach to save money and support a stable and healthy environment is to drive an electric vehicle like the Nissan Leaf, Ford Focus Electric, Tesla Model S, or Chevrolet Volt.

Due to the large amount of carbon emissions produced by cars, which are released into the atmosphere, we are more susceptible to pollution and greenhouse gases. An electric vehicle is a big improvement for the environment in which we live. You may get government grants for being environmentally conscientious by purchasing an electric vehicle. Even though you could wind up paying more for your car, the benefits far outweigh the drawbacks. When thinking about making an investment in an electric car, there are still two aspects to take into account.

Rechargeable batteries installed within the vehicle provide electricity for EVs. In addition to being utilized to power the vehicle, these batteries also enable the wipers and lights to operate. Batteries in electric automobiles are larger than in conventional gasoline vehicles. The batteries are the same sort that are often used to start a gasoline engine. The main difference is that there are more of them in electric cars, which are utilized to power the engine.

Even though many individuals are transitioning from traditional gasoline or diesel automobiles to electric vehicles, other people are still on the fence about the conversion for a variety of reasons, one of which is the charging period.

Advantages of electric cars:

1.No gas required.

2.convenient

3.cost saving

4.less running cost

5.no emissions

6.reduced build complexity

7.reduction in noise pollution

8. Easy driving

Even though there are several advantages discussed as above there are some disadvantages in the Evs such as:

1.Recharging points

2.Recharging time

3.Initial investment

4.Cost for electricity bill will be more

5.Short driving range and speed.

6. less noise can sometime be disadvantage

7.Battery replacement

8. Not suitable for city having shortage of power

9. Less amount of choice for cars

To overcome the above the situation calls for several new implementations, ideas and technologies. Static plug-in charging is the most common kind of accessible charging. Nowadays many new technologies are being in research and are being tested in the real life scenarios.

2. LITERATURE REVIEW

Performance analysis using ferrite core in dynamic wireless charging using u shaped core has been discussed by[1]. Method of enhancing the dynamic wireless power transfer using model predictive control is explained by[2]Dynamic wireless power transfer using mobile disseminators have been implemented and discussed by [3] . Wireless power transfer and reduction in complexity of the design has been designed and have been discussed by [4]Thge author have witnessed several papers regarding the static and dynamic wireless electric vehicle charging applications and pros and cons.[5]High power applications utilized by electrical automobiles have been addressed by [6].

In order to increase the efficiency, form the above-mentioned technologies, we are preferring an alternative method.

3. METHODOLOGY

The suggested proposal includes a technology that aids in charging a car even while it is in motion, in addition to this standard technology. With this technique, the underground power line will serve as the transmitter coil, and the vehicle will serve as the reception coil.

This technique operates on the electromagnetic induction transfer theory, as said in Figure-1.

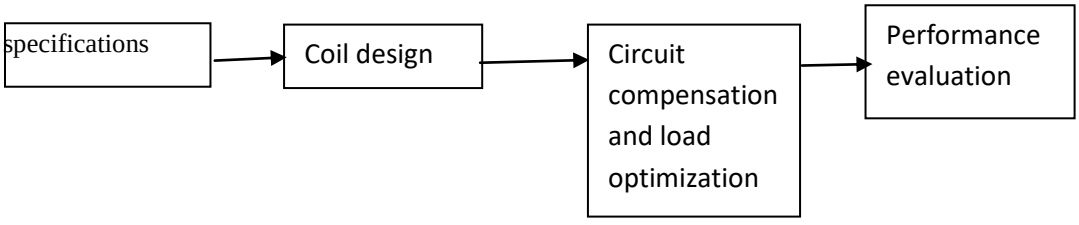

Fig-1: Flowchart

Algorithm of Proposed work

1. Two coils are involved in this technology.
2. The transmitting coil is being integrated with the underground power line.
3. The supply of the transmitting coil is given with a frequency of 25KHz
4. The power from the transmitting coil is transmitted to the receiving coil
5. The receiving coil will be built in the bottom side of the car
6. The principle behind the transfer of power is electromagnetic induction transfer.
7. The power is then supplied to the vehicle's battery directly.

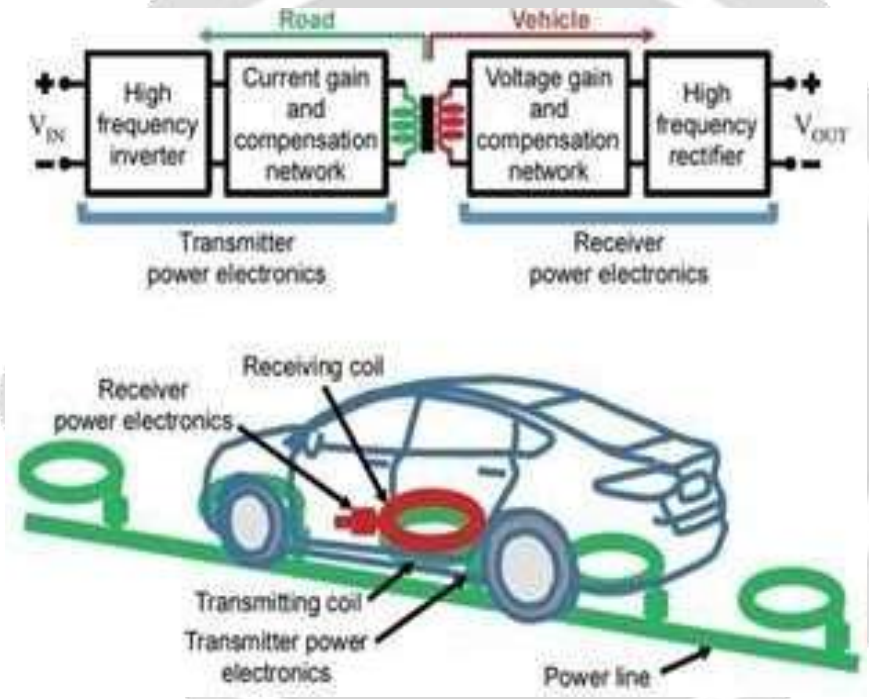

Fig-2: Existing Technology

The existing solution, Figure-2, utilizes a transmitting section and a receiving section. The transmitting section has a high frequency inverter and a current gain and compensation circuit, while the receiving end has voltage gain and compensation circuit along with a high frequency rectifier. Both transmitting and receiving ends has a single coil in the technology and the transmission loss might be high. In order to avoid these types of losses we require a new technology.

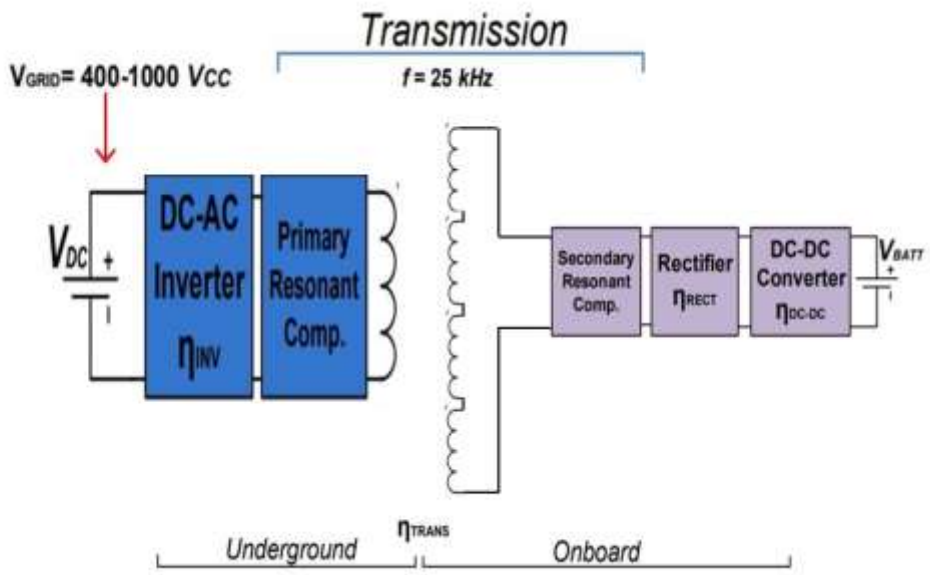

Fig-3: Proposed block diagram

In the proposed method, Figure-3, the first and foremost requirement that needs to be implemented in the pre-existing solution is that the power loss must be reduced. And the proposed solution is capable of delivering more efficient power transfer than the existing solution. The solution is constructed with a 4-block receiving end or quad coil setup which. By using this more effective utilization of area is done and the transmission rate is increased.

The calculations involved are as follows:

- ***For city cars: Volkswagen, Toyota, Skoda, etc,.***

1. Average length: 2695mm to 3665mm
2. Average height: 1460mm to 1610mm
3. Average width: 1475mm to 1665mm

By taking an average for the width of the car we get, 1570mm, I.e 1.57m

a) ***Condition1(25% of 1.57m):***

25/100*1.57=0.3925m

Total coil width:1.57-0.395=1.1775m approximately equals to 1.18m

Thus this 1.18 becomes the total width to be occupied

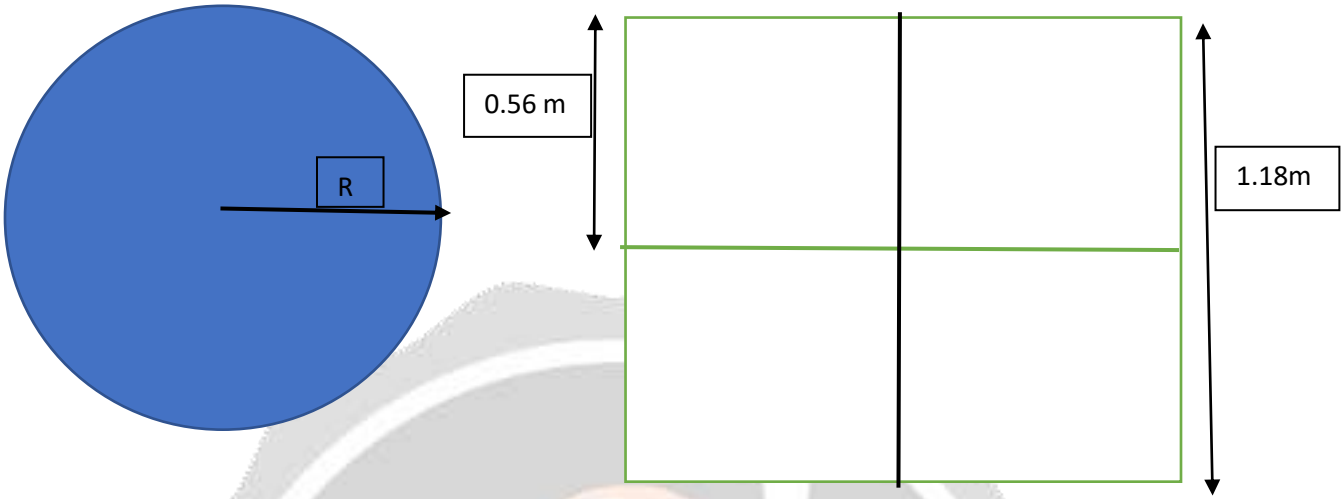

Fig-4 : Assumptions For The Quad Coil

Area enclosing single coil: 0.59*0.59=0.3481 m^2

In Figure-4, a square shaped area and a single circular coil are seen. Four of these coils are positioned within the square to make the most efficient use of space, and providing the better efficiency.

The suggested system employs a wireless transmission technique without the need of plugins, only employing coils. Two coils are being used here, in accordance with the theories that are now accessible. In figure-5, he primary coil, which is integrated with the power line, is used underground. While the car's undercarriage's secondary coil is being installed. But since a single coil is being employed in this function the efficiency of the power transfer becomes a huge doubt, but according to our proposed solution the efficiency is to be increased and optional construction is being employed using the pantograph technology.

However, since just one coil is being used for this purpose, the effectiveness of the power transfer is seriously questioned. However, in our suggested approach, the effectiveness is to be raised and optional construction is being used using pantograph technology. When compared to the suggested solution, normal charging is more expensive. There are options for pantograph technology that can be used here, similar to how power transfer occurs through the pantograph as a medium in railways. The technology can be used here for various types of areas with special DSP processors that can sense the topology of the road, and the existing technology uses a single ended transmitting and receiving coil while we have dual-ended transmitting and receiving coils.

The usage of a quad coil arrangement is primarily intended to increase efficiency. This technology can be used on highways; however, a separate track needs to be set aside where the transmitting coil will be linked to the subterranean supply and the receiving quad coil will be put in the vehicle. The suggested solution is best suited for typical autos with generally accessible standard ground clearance. For this configuration to work, the vehicle must be modified in order to install the coil.

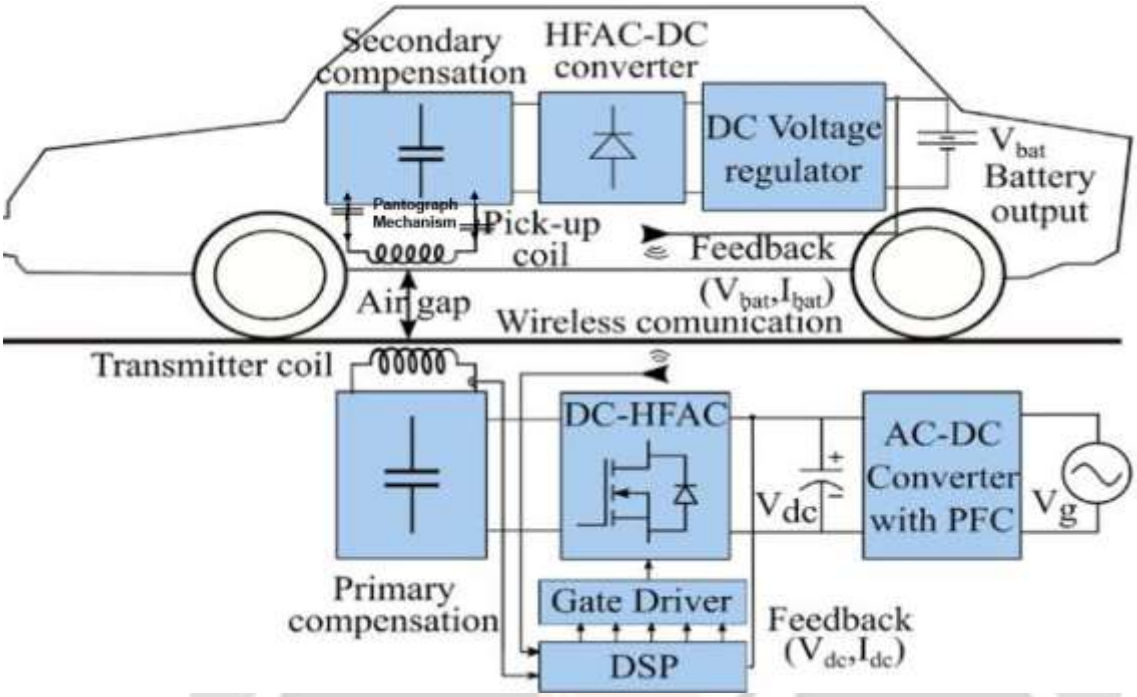

Fig-5 : Modified Block Diagram with Pantograph

The system must then be made available for all other sorts of road topologies, as the current approach is limited to highways. The suggested remedy employs pantograph technology to make it appropriate for various types of road layouts. the transmitting end's fitted DSP. The installed DSP gives the topology information of the road the vehicle is travelling. Analysis have done by making calculations and comparing with the traditional design and have been tabulated as below in Table-1

Table-1: Comparison table of system with existing and proposed system

Types of system	Height(mm)	Input power(KW)	Output power(KW)
Existing system	180	50	29.55
Proposed system with pantograph	180	50	39.05
	100	50	44.75
	85	50	45.25
	30	50	47.25

4. CONCLUSIONS

The single coil in the previously mentioned work has been altered to a quad coil, which offers a significantly higher level of efficiency. In addition, the requirement to use this technology for all road topologies has been met using pantograph technology, which, in simpler terms, uses a DSP processor to retrieve the information about the road and then moves the coil accordingly to offer a higher level of efficiency.

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