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Wireless EV Charging Station

Shreyash S. Gawande, Sahil A. Kachare, Shivraj V. Tangade, Amol R. Choudhari, Ajay N. Rathod, Prof. Oinam Romario Singh

U.G. Students Department of Electrical Engineering, Shreeyash College of Engineering and Technology, Chhatrapati Sambhajinagar

Assistant Professror, Department of Electrical Engineering, Shreeyash College of Engineering and Technology, Aurangabad, India

ABSTRACT

For electric vehicles to be efficient, they must have fast, cheap and reliable charging systems.

Compared to traditional charging systems, wireless charging systems eliminate the hassle of plugging in chargers. Additionally, wireless payment is considered environmentally friendly and user-friendly as there are no wires and electronic devices and related equipment connected. This article reviews methods and technologies for wireless charging of electric vehicles. First, the general technology of wireless transmission is described and explained.

Compare and contrast two elements of wireless charging, capacitive power supply and inductive power transfer. Then, wireless charging technology for electric cars will be broken down and discussed in depth. Fixed and dynamic wireless charging systems are discussed and examined. In addition, the same structure and design of dynamic charging systems (mobile vehicle wireless charging systems) were also studied. Controlling the operation of the electric vehicle wireless charging system is very important for its efficient and effective operation. These are also discussed in the context of improving power transmission and improving communication between the transmitter and receiver side of the vehicle payment system. The battery is an important part of the electric car because the difference in charge depends on the characteristics of the battery. For this reason, battery models are analyzed by comparing different batteries. The results of this state-of-the-art review are discussed and suggestions for future research are offered.

Introduction

The increasing demand for energy products has led to many benefits that affect the environment. Resources are depleted and large amounts of carbon dioxide are released, causing the greenhouse effect and global warming (Wang and Cheng, 2020). As a result of the Paris Agreement, carbon dioxide levels are being reduced and global temperatures are being controlled (Saerbeck et al., 2020). The development of clean energy and other technologies has solved these problems. Although technological developments have reduced greenhouse gas emissions from transportation, approximately one-third of emissions originate from this sector (Napoli et al., 2019). According to Outlook (2010), population and cargo growth will lead to a 77% increase in cargo by 2055. For the above reasons, the research and use of electric vehicles (EVs) deserve great attention. Electric vehicles have little or no emissions and low noise, which can reduce traffic accidents and create a healthy environment (Sanchez-Sutil et al., 2015; Abid et al., 2022; Huang et al., 2022), Chakir et al. , 2022; Lan et al., 2022; Soares et al., 2022; Guo and Zhao, 2015). Due to the transition to zero-emission cars, the automobile industry has switched to zero-emission cars (Bräunl et al., 2020; Domínguez-Navarro et al., 2019). Approximately 1.5 million battery electric vehicles (BEVs) were added to the global BEV fleet in 2019 (Martins et al., 2021), of which approximately 4.8 million are in use worldwide.

In the right location, EV charging stations are essential to provide cheap, clean electricity generated from the grid and renewable energy sources, thus accelerating EVs (Alhazmi et al., 2017; Sathaye and Kelley, 2013). Establishing a suitable charging station network will help reduce vehicle owners' concerns about electric vehicles and enable electric vehicles to compete with electric vehicles in the business field (Clement et al., 2014). Increasing the market share of electric vehicles and addressing the continuous development of payment technology. The current challenge facing the adoption of electric vehicles is the “chicken and egg” theory (Greene et al., 2020). Customers are interested in making the necessary payment that can successfully complete the journey or at least pay for the delay. Therefore, investors expect enough electric cars to hit the road to make the payments center profitable. Stakeholders are divided on whether fast charging or smart charging is suitable for power plants. Government policies also play an important role in solving these problems (Wolbertus et al., 2020). The lack of affordable batteries that can store enough energy for long periods of time to power electric vehicles is another important factor hindering the adoption of electric vehicles (Benysek and Jarnut, 2012; Nie and Ghamami, 2013; Ghosh, 2020). < Moreover, the optimal location of EVCS and the impact of EVs on distribution have become important research topics in recent years (Lam et al., 2014). Therefore, in this article, the authors review the DNO method, EVCS user method, and EVCS master method to determine the location of EVCS. Extensive research has been published on deploying EVCS using DNO methods, such as reducing busbar voltage, reducing power loss in distribution systems, and improving reliability. The placement of EVCS has been analyzed in other studies by EVCS investors and, to a lesser extent, by EV users. According to Liu et al. (2012) used an improved primary-pair interior point algorithm to determine the optimal location of EVCS, including investment, operation, maintenance, and loss costs. Ref. Islam et al. (2018) presented a multi-objective optimization problem with minimum transportation, station construction and energy loss costs for the FCS project. Additionally, Pal et al. (2021) presented a preliminary study including power loss, voltage differences, electric vehicles, and land costs. The 2 m point estimation method (2 m PEM) was used to control the uncertain changes of electric vehicles, and Harris Hawks Optimization (HHO) was used to solve the optimization problem. Ref. Gamp et al. (2020) proposed a two-level fuzzy method to optimize the location of distributed generation (DG), shunt capacitors, and charging stations. According to the first method, a multi-objective optimization problem is used to place DG and SC, and according to the second method, a multi-objective problem is used. The power dissipation and voltage curve is used to solve the optimization problem. Grasshopper Optimization.

Three big changes are currently taking place in transportation: driving, integration and electricity. Therefore, designing EV charging infrastructure must consider the integration and interaction of these three major changes. As the prevalence of electric vehicles increases, the demand for electricity from the grid will also increase, which will require replacement of the system (Green II et al., 2011). Transmission lines cannot carry as much power as distribution lines, which limits the amount of electricity that can be distributed (Zhang et al., 2011). In order to meet the demand of electric vehicles, a large distribution network installation is required. A comprehensive assessment is required to evaluate the potential impact of network operations on large-scale renewable energy (REG) projects and power plants (EVCS). Electronics can perform such analyzes to create effective tools (Farhoodnea et al., 2013). Figure 1 shows the charging of each charging station for electric vehicles (Borlaug et al., 2020). According to research (Lee et al., 2020), the most popular and important charging stations for electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs) are home charging stations. Creating a good payment system requires good communication to exchange information, optimization to reduce the payment time of payment centers, and predictions to help the optimization unit make the best decision (Shukla and Sengupta, 2020). The simultaneous adoption of many electric vehicles is a challenge for the electric industry. Various measures have been taken to solve these problems.

There are many recommendations regarding the design and installation of electric vehicles (Tie and Tan, 2013). In order for electric vehicles to be competitive in the market, the impact of battery costs, the effectiveness of charging strategies, the impact of charging stations and the integration of electric vehicles with the grid must be mentioned (Singh et al., 2013). The development of international standards and specifications, infrastructure, peripheral equipment and user software will be important for the development of electric vehicles in the next decade (Arancibia and Strunz, 2012). There are many scientists working in these fields around the world. To expand the electric vehicle market, it is important to understand the evolution of electric vehicle charging and its impact on the grid. Charging of electric vehicles (Yılmaz and Krein, 2012a), integration of electric vehicles into smart projects (Tan et al.,

Introduction to Wireless Charging:

Wireless charging, also known as wireless power transfer, is a new technology that allows the base station to transmit electrical power without a series connection to the power source. Due to its comfort and providing a better experience for customers, this development appeals to a variety of uses, from low-level toothbrushes to large vehicles. Today, from a product model perspective, this development occurs very quickly, especially if there is a problem with the smart device. Many automobile manufacturers such as Samsung, Apple and Huawei began to announce their new phones that come with wireless charging feature. Now theory is quickly becoming part of the business structure, especially if there is a problem with smart technology [1]. Many automakers such as Samsung, Apple and Huawei have begun to announce new mobile phones with their own wireless charging functions. IMS Survey predicts that the wireless charging market will surpass wireless charging to reach $4.5 billion by 2016. Parker predicts that wireless controllers will increase and the market size will reach $20 billion by 2020. Radiative wireless charging uses electromagnetic waves, radio frequency waves or microwaves to enter the environment as electrical exchange. The power change depends on the voltage field of the electric current. These charges generally operate in low-lying areas due to health concerns caused by radio frequency exposure. On the other hand, non-radiative wireless charging takes into account the magnetic field coupling between two loops in the twisted approximation of the distribution of energy transfer. Separation is particularly important in this advancement because the magnetic field of the electromagnetic wave decays faster than the electric field. Due to its non-electrical properties, this development is used as part of cascade charging [2]. In addition to the above promotion, there is another promotion created later. This is "acoustic energy transmission". In this case ultrasound is really being used for power trading. The rule for its development is ultrasonic echo. This development has an average penetration into the market as it will be efficient and environmentally friendly This article gives an overview of the development of wireless charging infrastructure and its applications in head technology and communications. This view includes many true wireless charging drivers such as inductive coupling, magnetic reverberation coupling, RF/microwave radiation, acoustic (ultrasonic reverberation). This article consists of continuous points to explain how wireless charging came into being, i.e. its history and the details required for the wireless charging industry miracle [3]. Additionally, the various wireless payment technologies that have emerged to date have separate block diagrams, flows, uses, applications, advantages and disadvantages.

History of wireless charging:

Electromagnetics is the pioneer of the wireless power industry. The study of electromagnetism began in 1819, when HC Oersted discovered that electric current creates a magnetic field around itself. Later, Ampere's law, Biot-Savart law and Faraday's law were derived, which gave some important properties of magnetic properties. Following them is J.C. Familiar with many situations, Maxwell described in 1864 how electric and magnetic fields change and modify each other. Later, in 1873, Maxwell wrote the Treatise on Electricity and Magnetism, which brought together electricity and magnetism. It is said that from now on and in the future, power and influence will be limited by equal measures. Later, alternative energy pioneer Nicholas Tesla was the first to experiment with the use of microwaves for wireless energy transfer. In 1896 he focused on the long-distance movement of electrical power and understood the trade-off of microwave signals over a range of 78 kilometers. Another important advance was made in 1899, when 108 volts of high-frequency electricity was transmitted over 25 miles, lighting up 200 light bulbs and generators. Still, the technology used by Tesla needs to be questioned because the transmission of such electricity in an electrical bend can have a serious impact on the electricity of nearby people and electrical equipment.

Basic Principles of Wireless Charging

The process of wireless power transfer is really similar to the basic communication process. Power must be transmitted from the transmitter to the receiver using various channels or techniques (e.g. coupling methods, RF techniques) as well as message exchange. In simple communication, the transmitter to the receiver must be made using various methods. to move. Good signal. Simply put, wireless charging technology is similar to the communication picture.

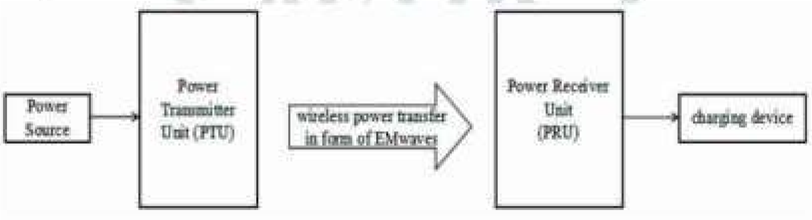

Fig.1. Block Diagram of Basic Wireless Charging Device

Wireless Charging Technology

This section provides important information about wireless charging, including the development model, the use of current developments. There is also the engineering design, hardware and usage of the payment system.

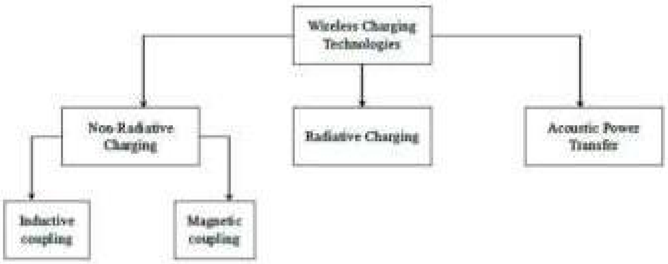

Fig.2. Classification of the Wireless Charging Technologies

Non-Radiative Charging: Generally the square structure of non-radiative, non-radiative wireless charging system has a side transmitter which includes: i) an AC/DC rectifier which converts current (AC) into coordinate current (DC); ii) DC/DC Converter which changes the voltage of the DC source starting from one level to the next level; iii) DC/AC Inverter which converts DC power into AC power. Side effects include I) an AC/DC rectifier (to convert high-frequency AC to DC), ii) DC/DC converter (to control DC voltage), and iii) a bank for charging. The wireless payment process is as follows. At first the power needs to push the AC/DC rectifier. Since commercial AC power usually operates at a frequency of 50Hz or 60Hz, which is too low to consider wireless driving, the charger first converts the AC power to DC power, then increases the DC power, and then converts the DC power to AC power for expansion. AC frequency. Let's go back to high frequency AC power. Because the high-frequency alternating current coiled by the emission ring will produce magnetism. In the surrounding magnetic field, alternating current is excited around the loop, which is separated from the emission loop by pores. Meanwhile, the power receiver converts the starting current into direct current into the required voltage for the group. Batteries of electronic devices can be changed in groups [6]. Considering the combination of the force exchange cycle, the above developments should also be divided into three types. These are inductive coupling, magnetic coupling and capacitive coupling. In this type of capacitive coupling, the measured value of the coupling capacitance depends entirely on the area involved in the installation. However, it is difficult to achieve the large amount of energy required to support the experimental plan for various electronic devices because it is achieved by two methods such as non-radiative charging, magnetic inductive coupling, magnetic Reverb coupling. These are suitable for operation near electromagnetic fields near the transmitter and receiver. In remote applications, radiation is stored without affecting the receiver. On the other hand, in applications close to the handle, the group is greatly affected by the field provided by the emitter. This is because the transmitter and receiver are not together in remote applications. Inductive coupling: In this method, electric current moves between two circuits according to the magnetic field. Induced power transfer (IPT) occurs when, in other cycles of the energy received in the field, the coil is energized by a source that produces a vastly different magnetic field, usually not exactly the frequency of the field. A current/voltage is created in the area near the handlebar by the auxiliary bending of the receiver. This starting voltage can be used to charge wireless/storage devices. This method is generally used at frequencies up to kilohertz. The selection cycle should be adjusted during operation keeping in mind the end goal of improving payout. In fact, the best circuit is designed to be maintenance-free, providing a quick replacement path to achieve good results. Due to lack of respect for the best, the charge difference was reduced to centimeters. Key points: The advantages of inductive coupling include simplicity, efficiency, high productivity (found in tight isolation applications where the isolation is not as extensive as a loop) and guaranteeing safety. Therefore it is necessary for installation and is used frequently. This technology is now widely used and is the first technology introduced by Samsung. It only affects applications where the remote location will be close to the process; This is wasteful and is a downside of this update.

Magnetic Resonance Coupling: In this method, periodic wave coupling as coupling creates and moves the electric current of the popular circuit by changing or influencing magnetic fields. Since the two loops operate in the same noisy circle, they focus together with great power of the cell and very little diffusion into the noiseless ones. Due to the nature of reverberation, magnetic reverberation coupling is essential for the effective operation of the field and identification of the trading channel. Magnetic coupling resonators can transmit force for longer periods of time than inductive coupling and are more efficient than traditional electrical methods. Additionally, a transmitter resonator can be connected to more than one receiver resonator. Therefore, it can charge different devices at the same time.

Highlight: Since the magnetic reverberation coupling generally operates at megahertz frequency, the quality of the resonator is very high. As the separation potential expands, the coupling between the resonators will decrease, leading to a weakening of the charge. Due to magnetic resonant coupling, different components can be charged simultaneously by adjusting the coupling resonators of each receiving loop. However, the resonators must be adjusted correctly as the connection between the receiver loops will cause interference.

Radiation Charging: In this innovation, RF radiation uses scattered RF/microwaves as a means to deliver radiant energy. Radiofrequency waves are generally created by traveling through space at the speed of light. The frequency of microwaves is between 300MHz and 300GHz. Infrared or X-ray electromagnetic waves are used to transmit energy, but unlike microwaves, the radiation is very harmful.

The transmission of energy begins with the conversion of AC to DC and then DC to RF via the magnet on the transmitter side. RF/microwaves received at the receiver's antenna are converted back into energy by converting RF to DC after being produced by the air. RF-DC conversion efficiency depends on the receiver's power availability, the accuracy of the radio and electronic signal combination, and the ability of the electrical connections to convert the received RF signal. For DC voltage.

Features: RF energy can be sent isotropically or collected in one direction. This option is mostly used in important communications and advertisements. Beamforming can transmit electrical energy, called irradiated energy, which can expand the transmission of energy. The frame is made of wire. The sharpness of the beam energy increases with the number of transmitted and received lines. Using a large receiving equipment container can improve the clarity of the energy. Continuous development has created a large group of low-quality cables such as power transmission transmitters and electronic equipment.

Introduction to Wireless Electric Vehicle Charging Station:

Wireless power transfer

Powering and charging electronic devices and appliances

Also considered since the days of Tesla. However, this was not possible due to lack of technical support at that time. In 2007, scientists achieved this goal by shining a light bulb with electrical power from a distance of

two meters[1]. Since this great success, the field has been greatly developed [2,3]. Electric vehicle (EV) charging is one of the many areas where wireless charging options

(WPT) have great potential and are being researched for their many advantages[4,5].

Traditional wired or plug-in charging system

As a conductive charging system Also called. There are some problems with these charging cables. For example, they need heavy equipment and accessories. The charger then needs to be manually connected to the power source and the device charged [6].

Wired charging systems are also harmful to users and the environment

[7]. Temperature, friction with ground or the charger itself, etc. If the insulation layer of the charging cable is shortened or broken for some reason, it will cause electric shock, which will lead to death [8]. To reduce the charging time and therefore the associated risk, more batteries can be used

or batteries with no capacity can be replaced with rechargeable batteries when necessary [9]. For example, if a car can travel a certain distance on a single charge using a particular battery, the range can be increased by using more batteries. Alternatively

the vehicle battery can be replaced with a battery that is charged at the charging station while driving. But batteries

also have their own problems[10]. Batteries are heavy, have a high initial cost, and have a short lifespan. Due to its weight, it will not be able to carry more than one large battery. Future innovations in electronic technology may help solve these problems. However, another method to solve battery-related problems is WPT [11].

For example, the use of large batteries and large batteries can be avoided by using a wireless charging system [12]. In addition, the WPT method is simple and easy to use because it eliminates cables and connectors

The reason why the WPT system is used in these applications is that it is safe, simple and flexible. Using this technology

, battery-powered devices can be dynamically charged

. This system is also useful during the rainy season because there are no wires and the risk of electric shock is low. It is also flexible, does not require positioning and supports mobility.

Vehicle wireless charging also uses WPT and can be done in three different ways: static or fixed

wireless charging system (SWCS), semi- or semi-dynamic wireless charging system (QDWCS) and dynamic. Wireless Charging System (DWCS) [27,28]. In SWCS, WPT

is used to charge electric vehicles. Semi-QDWCS uses WPT to charge the vehicle's electrical power when the vehicle stops briefly while driving. For example, an

EV will stop on the bus and use WPT to pay the

EV fare. Dynamic charging systems aim to charge electric vehicles while in use and on the move.

In this study, through in-depth examination of case studies, we discuss and analyze the operating models, methods, equipment, methods and other factors related to wireless charging of electricity of fire trucks. Some of the important contributions of this project are listed below.

• A review of relevant research articles and table summaries are presented.

• A comprehensive discussion of the WPT method has been given previously.

Go into the details of wireless charging technology for electric cars and the various technologies used for this purpose.

• SWCS and DWCS are reviewed and the design process is documented.

•Develop IPT-based DWCS review and decision models.

• Wireless Charging System Communication and Control

System misalignment and power control are discussed.

Wireless Power Transfer:

In WPT systems, near field and long distance transmission can be used to transfer electrical energy from one place to another [40]. The medium used for remote WPT can be acoustic, microwave or optical. For near fields, capacitive or inductive coupling techniques are often used for non-radiative electric, magnetic or electromagnetic fields.

Microwaves can be used to transmit energy using frequencies ranging from 1 GHz to 1000 GHz [41] .

In the optical method, energy is transmitted by laser light

[42]. Both microwaves and lasers can be used to transmit electricity over long distances. However, both require a clear line of sight between the transmitter and receiver.

These also affect humans and biological life. Some work has also been done on electric vehicles using microwaves [43,44] and lasers [45]. However, these have not yet been used commercially [46].

Using wireless connectivity, WPT is an effective wireless charging technology [47]. This way of coupling can be capacitive or inductive. Capacitive coupling using capacitors forms the basis of CPT, while inductive coupling using inductors forms the basis of IPT. Compared with IPT-based wireless charging, CPT based wireless charging provides lower power and the charging range is smaller [32]. Therefore, IPT-based wireless charging technology is considered to be better and is used for commercial deployment [48].

In WPT based inductive coupling, current is generated by mutual inductance [49]. A pair of coils is used to conduct electricity. One of the coils is the primary coil and can be thought of as an antenna used to transmit electricity. Other coils can be made.

Electric Vehicle Charging Technology

The technology used for electric vehicle charging

can generally be classified as wired or wireless. Wired conductive charging can be divided into three different levels: Level 1 (L-1), Level 2 (L-2) and Level 3 (L-3) [118,119]. Similarly, wireless charging technology can be divided into two main categories such as CPT and IPT. Compared with the CPT method, IPT is considered the most popular technology for wireless payment [32, 60, 61]. Wireless charging technology can also be divided into static and dynamic methods [86,91]. These different systems and their further classification are shown in Figure 4 [32, 86, 118].

Capacitive Power Transfer Technology for Charging

Power transfer in the CPT system uses electricity. The electric current exhibits only a small amount of energy as it passes through the electrical separation of the magnet [120]. Therefore, it is thought to be suitable for electric vehicle charging [80]. Power transfer is done by capacitors. These capacitors are made using cheaper metals. For example, aluminum for charging

Inductive Power Transfer Technology

An IPT system can be divided into two main parts; The primary side conducts electricity and the secondary side conducts electricity. buys electrical equipment. In EV charging systems using IPT, the first side of the IPT system can be placed on or under the road, while the second side can be installed on the moving vehicle [124,125]. The first side sends energy to the second side. Power supply

Mas. depends on the power requirement of the application or device used. If the device is charged with electricity single-phase or three-phase systems will be used.

On the other hand, if the device requires less energy a small battery will be sufficient [126]. An inverter is used to convert low frequency to high [127].

Power switch between primary and secondary coils

Charging Pads:

Single or multiple third pads can be used by a power supply in SWPT and DWPT. Transmitting more data does not require more energy [190]. Charging plates are available in different types such as circular, rectangular or double D coils [191,192]. Different types of materials are used in coil making. Copper is the most common material but other materials are still being tested [193]. High temperature superconductors (HTS) are highly preferred due to their properties [194]. While SWPT uses a single release pad, DWPT has other possibilities. For example, a long train or multiple switches can be used to charge electric vehicles [195]. Both methods have advantages and disadvantages. Long nails can help reduce the number of pieces and control difficulties [179]. The advantage of using a long transmission line is that it provides constant power and current to the electric vehicle when it enters the road area. However, if the rail is used with an electrical source, the cost of the product increases [196]. Additionally, this will cause a malfunction in the system; if there is a problem at some point, the entire system will shut down.

Therefore, the reliability of the system is reduced. Also, if there is a significant difference between the electric vehicle and the length of the track, this will result in reduced connectivity between the two. Therefore the system failed[4]. The coupling is also affected by air gap and coil distance. There is a difference between distance and connection. The size of the coil is also very important. Similarly, if there is a large difference between the size and the secondary coil, this will result in less connection between them.

Many power supplies, high frequency inverters and equipment in large topologies. However, this topology is redundant and more reliable because it prevents single failure [4,197]. If the system is not working, the system can still work. Additionally, effective use of switches can reduce the number of devices. Since multiple outputs are used in this system, only one EV bypass can be activated while all additional outputs can be disabled. This will improve the required connectivity and reduce power consumption [195]. However, this topology increases cost and system complexity. In this system, the spacing of the pads is also important and should be optimized. If the distance between consecutive windings is too small, incorrect connection of the windings will occur and the strength will be broken [198]. If the distance between the pads is too large, there is no need for connection, but power will not be transmitted continuously.

This will also have a negative impact on the grid.

Magnetic Structure of IPT Systems:

Researchers have developed various magnetic structures for IPT charging systems [193,200,201]

. Some of the magnetic patterns commonly used in electric vehicle charging are:

· Bipolar Pad (BPP),

· Circular Pad (CP),

· Double D (DD). <for< b="" style="margin: 0px; padding: 0px;"></for<>single-phase mode operation, CP and DD magnetic samples are used as master data [202]. The number of phases in the magnetic structure is determined by the number of coils used in it [203]. Different types of magnetic fields can be created by using different magnetic patterns. In the CP model, the magnetic field produced is generated from the center of the outer coil, while in the DD model, the magnetic field is generated along one axis of the pad [202]. CP and DD models use ferrites under the coils to create a magnetic field on one side. This increases the coupling coefficient between the transmitting coil and the receiving coil. In the CP model, the magnetic field is dispersed. Therefore there is a small flux [204]. It also reduces the coefficient when the second part is misaligned.

In a DD model, the coil is wound to form two magnetic poles of opposite polarity [133]. two poles. Therefore, the tolerance for misalignment and magnetic resonance is better compared to CP models [203]. However, the flow rate of the DD structure is higher than the CP structure. In BPP there are two coils separated from each other.

These can be used in different ways due to the difference in the level and size of the initial flow [205]. In BPP it is now used to drive the steering wheel Since in-phase or out-of-phase is 180°, the magnetic equation of CP or DD can be established as [124]. It can operate out of phase at another angle (not 180°) to create a different magnetic image. Due to its phase-shifting ability and flexibility, BPP is a suitable candidate because performance can be improved through modifications.

Discussion and further research:

As technology support evolves and progresses the acceptance of electric cars has increased and more people are now driving more than before. In order for electric vehicles to drive properly, they need a sufficient amount of battery to store energy.

Wireless charging for electric vehicles is an important enabling technology with many advantages over traditional wired charging. It allows the electric car to be charged without using a charger. Thanks to dynamic wireless charging, electric cars can be charged while driving.

Wireless charging solutions reduce battery size and startup costs, save time and delay driving.

However, many wireless charging solutions still need further development, and this can be achieved through technological advancement.

Some features and lack of more electricity, size, safety and security required for wireless measurement systems [283]. However, it is difficult to achieve all these objectives and trade offs are needed to develop a practical EV wireless charging solution [38]. For example, fast charging systems are limited by the physical dimensions of

As efficiency increases use high efficiency to reduce coil size and coil current and turns are reduced without affecting power dissipation. However, high frequency operation may cause higher fluctuations in the inverter [284]. Additionally, since the semiconductor devices of high-frequency devices can cause high temperatures, cooling systems are needed. Therefore, the best coil design requires a balance between coil size and charging speed. In addition to fast charging, other electrical parameters such as power consumption, electric flux, Therefore, the best fastener design to achieve the above goals is an active research area and future research is recommended.

For an efficient WPT, the first side and second side coils must be aligned [285, 286]. Even a slight misalignment of the coils can reduce the coupling coefficient and cause reduced WPT efficiency [287]. Misalignment can cause flux leakage, which can degrade the performance of the system.

Magnetic flux leakage can also cause coupling with the metal near the object, which not only causes power loss but also may damage the object. Therefore, misalignment in wireless charging systems is an important problem to overcome [288]. Different techniques have been proposed to increase the misalignment tolerance. These techniques use different types of coil geometries, combining coils of different geometries into a single unit, using overlapping configurations and resonant frequency tuned circuits.

This process may require more space and more weight [289]. Therefore, their use in electric vehicles is limited. Similarly, improved topology compensation and radio-based methods are also proposed to resolve the error [121].

Other methods that do not rely on geometry changes, such as vehicle tracking and autonomous control, are also being investigated to solve the misalignment problem [236].

For example, sensors can be used to detect and measure mismatch between transmitter and receiver coils. An autonomous control system is then used to align the receiver coil with the transmitter. For SWCS, this technique can be used with automatic parking systems [237]. However, in the case of DWCS, the use of this system requires additional considerations such as vehicle type and vehicle speed. For future research, it has been shown that the deployment of sensor systems can be learned to improve the relationship.

Electromagnetic metamaterials can also be used to compensate for defects.

Also, the effects of misalignment can be addressed using compensation and integration. Improving communication and management can also be learned to solve the problem of misalignment.

When the wireless charging system is used to charge the electric car, there is an open space between the wireless charger and the electric car. Foreign objects may fall into the body of Muhammad Amjad and his friends. Page 18 / 29

Wireless Charging System for Electric Vehicles This area is opened while electric vehicles are being charged [290,291]. Foreign objects that cause anxiety include metal objects, such as toys or tools, and living things, such as animals. For metal objects strong magnets can create eddy currents that cause the objects to heat up. Therefore, the payment system may deviate from its normal operation and lead to security situations [288]. If it is a living organism, the strong magnetic field will damage the living organism [292]. Therefore, wireless charging systems must undergo foreign object detection (FOD), which includes detection of metallic objects (MOD) and detection of living objects (LOD) [288]. According to the working principle, these data can be divided into three different types: search based on system parameters, wave-based search and local search [292]. For detection, system-based detection cannot use electrical parameters such as voltage, current and power or non-electrical parameters such as temperature and pressure [293]. Power consumption search is not suitable for MOD at low power consumption.

This process is cheaper because there is no additional equipment . However, the verified accuracy is lower than [294]. The detection method uses non-electrical devices that are inexpensive and suitable for both MOD and LOD. These are available for both low and high power applications. Their accuracy is low [295].

Wave-based methods can use different types of sensors for detection, such as proximity and ultrasonic sensors, radar and imaging, or thermal cameras. Control may use different types of waves determined by the equipment, such as mechanical or electromagnetic waves. This technique can be used for low power and high power applications as well as MOD and LOD depending on the device. This method has high cost and accuracy [296]. Field-based detection method using electromagnetic fields for FOD.

This method is suitable for both low and high energy applications and is capable of detecting metals as well as biological materials. These methods have moderate to high costs. Their accuracy is high [297]. For future research, wave-based or field-based detection methods or a combination of both can be used for FOD due to their high accuracy.

Exploration of the accuracy of this process in further research should be developed within the limits of cost, complexity, space and weight.

It is generally believed that electric vehicles with DWCS require smaller batteries [298]. This reduces the weight and cost of electric vehicles. However, small batteries may suffer from poor performance due to deep discharge and multiple charging cycles [299]. This will shorten overall battery life. Therefore this requires replacing the battery more frequently, thus increasing the cost in the long run. Additionally, smaller batteries will require more charging and more power. Therefore, if the batteries are too small, they will deteriorate quickly and they will have to be replaced more often, and they will also have to pay a large amount of money. Therefore, the total cost of the system will increase. Some studies have been conducted to measure the visual length of batteries and wireless charging systems [183, 188, 300, 301]. However, previous studies are limited, for example in [188] only the vehicle type in some regions is taken into account. In addition, the prices of batteries and electric vehicles have changed over time. Therefore, further research is needed in the future to determine the best battery and charging equipment, including the conditions and limitations mentioned above.

Interoperability of electric vehicles with various payment methods is another problem that needs to be solved. For example, the second side of the electric car is designed to have a high coupling coefficient, and the first side is installed on the wireless charging side, thus completing the electric transmission to a high degree. connection. Efficiency[302]. For this, the shape, size and payment network of the two parties must be compatible with each other [303]. Therefore, the design of wireless charging systems is needed. To support this goal, the SAE J2954 standard was adopted [304]. However, this model is limited to SWCS for light electric vehicles. Therefore, medium and heavy-duty electric vehicles cannot benefit from the infrastructure according to this model [305].

Interoperability of light, medium and heavy-duty electric vehicles will make it easier for vehicle types to use the same infrastructure, thus reducing the cost of infrastructure creation. Similar to SWCS, the interoperability of different types of DWCS will enable different types of electric vehicles to also use DWCS infrastructure. Moreover, the relationship between SWCS and DWCS is ideal. It should be possible to charge an electric vehicle on a single charge using SWCS or DWCS. Therefore, more designs are needed in the future to promote the efficiency and compatibility of different types of electric charging and different groups of electric vehicles.

Conclusion

We discussed and analyzed an electric car using wireless power transmission. Wireless charging is considered a better option than traditional wired charging systems as it is user and environmentally friendly. It also eliminates interference and danger by eliminating the need for cables and connecting devices. Wireless charging systems can also reduce stress and increase body efficiency. Generally speaking, wireless transmission is done via microwaves, lasers or wireless networks. However, wireless payments generally use only connection-based technology. Connectivity-based technology for power transmission and charging of electrical equipment,

inductive and capacitive power transmission. The two technologies were discussed, compared and contrasted, and it was concluded that inductive power transfer has advantages and is the first method of wireless charging of electric vehicles. For this purpose, static, semi-dynamic or semi-dynamic or fully dynamic methods of wireless charging can be used. This article describes the wireless charging model for electric vehicles. Additionally, key aspects of wireless charging such as chargers, charging topology, passive performance, communication and control are reviewed and discussed. Since many different types of charge are determined by the battery, a brief summary of battery types and models is also given.

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