

High Power Wireless Power Transmission

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Abstract- *High power wireless power transmission takes part in numerous fields. In the recent years the importance of wireless power transmission is widely increased in the Battery Electrical Vehicles (BEVs). The transmission of electrical energy to electrical load is done through without any wirable connection, which is done in the electrical air gap is said to be wireless power transfer. It is useful in coming years, as many countries are researching about the wireless transmission and implementing new ideas to transfer the power without wire connection. As the need of electrical energy is day by day along with that cost of the transmission, equipment is also increasing so that the losses also increase. In order to reduce the losses this wireless power transmission is required and suitable. Now here, we can observe the detailed information about the wireless transfer and its utilization.*

Indexed Terms- *Dynamic power charging, wireless power transfer, power electronics, inductive transformation, electrification of transportation of power, micro power transmission, couplers.*

I. INTRODUCTION

As the use of electrical energy is increasing day by day, the cost of the equipment is also increasing. As the need increases the losses are also increases while power is transmitted. Distribution lines are useful to transmit electrical energy through the cords. The equipment required for electrical power transmission increases which is dangerous to the environment. In order to reduce these losses wireless power transmission is helpful and also power is saved which can be stored and used when needed. There are some alternatives to reduce these interruptions.

In order to get addicted to the electrical vehicles, the electrical energy is needed so, it should be implemented or developed quickly and widely.

Cell electrical vehicles or Battery Electrical Vehicles (BEVs) are most widely used and the storage of energy is the essential component required for the BEVs. Equipment or infrastructure used in big-scale electric vehicles whether they are connected through wires or: without any connection through wires should be comfort, convenient, useful, needful, loss less, powerful.

Other than using diesel, charging of more or high power is the best way to decrease the cost and losses. It is proved that it does not do any harm and pollution free and also bio degradable and can be useful everywhere.

In order to gain the high power, the large-scale industries are showing much more interest and concentration.

Implementation or development of these wireless power transmission vehicles are accepted or wanted everywhere.

As per the information of technical report or Technical Information Report (TIR), it is declared about wireless power transfer consists of four levels. The highest one is 23KV and efficiency of 93% and 18.93% for the battery of electrical vehicles or device.

These high-power systems can be used at national highways, traffic lights, and in the big-scale vehicles etc..., and the beyond 23KV is used at the ranges of less frequencies.

INSTITUTE/ COMPANY	POWER PER PICKUP	AIRGAP (mm)	EFFICIENCY	FREQ. (kHz)	TYPE
KAIST [1],[2],[3],[4]	27kW 22kW	200 200	74% 71%	20 20	Track Track
WAVE [5]	50kW	178	92%	23.4	Coil
ETH Zurich [6],[7],[8]	50kW	100- 200	95.8%	85	Coil
Fraunhofer [9],[10]	22kW	135	97%	100	Coil
KRRI [11]	818kW*	50	82.7%	60	Track
INTIS [4]	30kW	150	90%	35	Track
Showa Aircraft Co [12]	30kW	150	92%	22	Coil
NYU [13],[14]	25kW	210	91%	85	Coil
Conductix Wampfler [6]	120kW*	40	90%	20	Coil

Table.1 Present Form of High Power Wireless Power Transmission

REF [1] Bredsen centre, the university of Tennessee, Knoxville.

Andrew Foote,omer C.onar

Keeping in mind the situation is very critical, as we are in lack of resources of electricity, it should be avoided the wastage of the electricity.

In order to reduce the losses and threats the wireless power transmission is came into force. It is proven that the wireless power transmission consumes no diesel and pollution free and takes less time.

In some of the references like [2] shown that the reliability and efficiency of the wireless power transfer in detailed manner.

And the references of [1] shown that the wireless charging to an electric vehicle to loads is done through the air gap and billions of daily electronic devices is differentiating a causeful power.

Inductive power is also called as wireless power transfer. This can be achieved without using cords. This proves that it takes less time to charge, power consumption is less, losses are low, and convenient in large scale industries or vehicles.

In order to charge the mobiles, laptops, monitors, DVD players, etc. needs the charging by connecting wires to the plug. But it can be done wirelessly to achieve power as discussed in the reference of [3]. But this wireless power transfer may require many satellites and connection with many devices (electronic). There are two methods in the wireless power transfer one is 1) Adjacent field method and other is 2) Distant field method. Here the adjacent field methods give the higher recurrence transmission and uncomplicated design measurements as shown in the reference of [4] [6] [28].

ADJACENT FIELD METHOD: this adjacent field method deals with the measuring with device adjacent from the power horizon. It is divided into three types i.e., electromagnetic emission, empirical coupling, reverberating coupling. These methods are helpful to avoid threats due to climatic and reliability treats.

II. ELECTROMAGNETIC EMISSION

The electrical energy from the transmission end to receiver end is, this process is called electromagnetic emission

The emission of energy is dependent on the two directions one is infinite direction and the other is mono directional.

In omnidirectional emission procedure, the frequencies changes to various values.

In infinite direction emission the transformation or migration of data is easy and comfortable. Efficiency problem also raise when energy is transmitting.

If the gap or stretch increases then the transmission of energy or electromagnetic waves gets decompose. As per the experiment, we come to know when a receiver is 30cm far from the transmitter, then efficiency is 1.5% [1].

There are many hazards or harms due to the electromagnetic radiation or emission. So, these can be protected by infinite directional emission

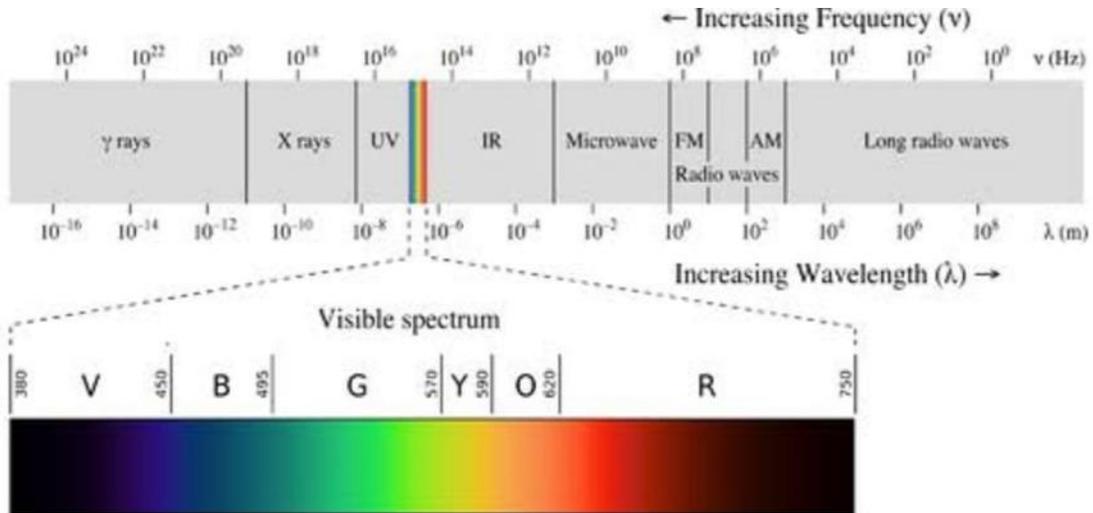


FIG.1 Electromagnetic emission. (Priyam study centre. Mar 5, 2020).

III. EMPIRICAL COUPLING

It is termed as the pairing between resonant circuit when the LC frequency is induction.

According to Faraday’s law of electromagnetic induction, it has two sources as we know that current passes through wire. As the primary side is given to a source which gives magnetic field produces voltage across secondary side. This primary side and secondary side play a major role in the empirical coupling.

These are given wirelessly due to their uses, profits, convenience, and safety etc.,

This empirical coupling is implemented in many electronic gadgets and devices came into force due to their benefits. These are utilized in different fields.

If the distance between these coils is not proper then it leads to reducing of power transmission or transfer. The distance between primary and secondary should be correct otherwise it leads to the unidirectional or imperfect power transmission.

The receiving end and the charging end should be close enough then the power transmission occurs properly and the distance between the ends should be in cm distance [1].

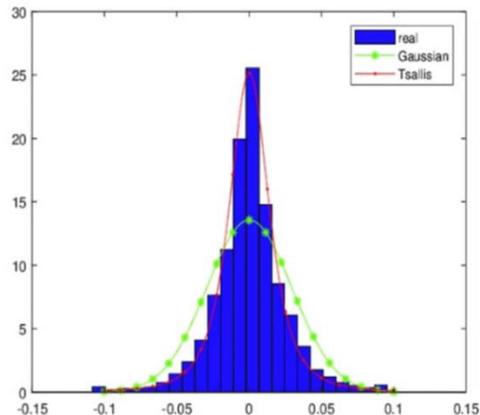


FIG. 2 Empirical Coupling.

IV. MAGNETIC REVERBERATING COUPLING

This is the most important one in the adjacent field method. The energy will be generated greatly around the primary side. If the frequencies are same it produces a sound if reverberating frequencies are same. Here the transformer is used for the not one reverberating thing.

This transformer inclusion makes the circuit or device more efficient, reliable and reduces the many losses and gives the particular path to the empirical coupling.

The meeting or combination of two empirical coupling and reverberating gives the strong output [1].

There will be some losses when transmission is occurring from receiver end to source end in order to these losses the transformer is came into force.

This enables the efficiency, reliability, neglects losses, convenient etc., the emission losses also decreases and it shows some path as compared with the empirical coupling [1] [5].

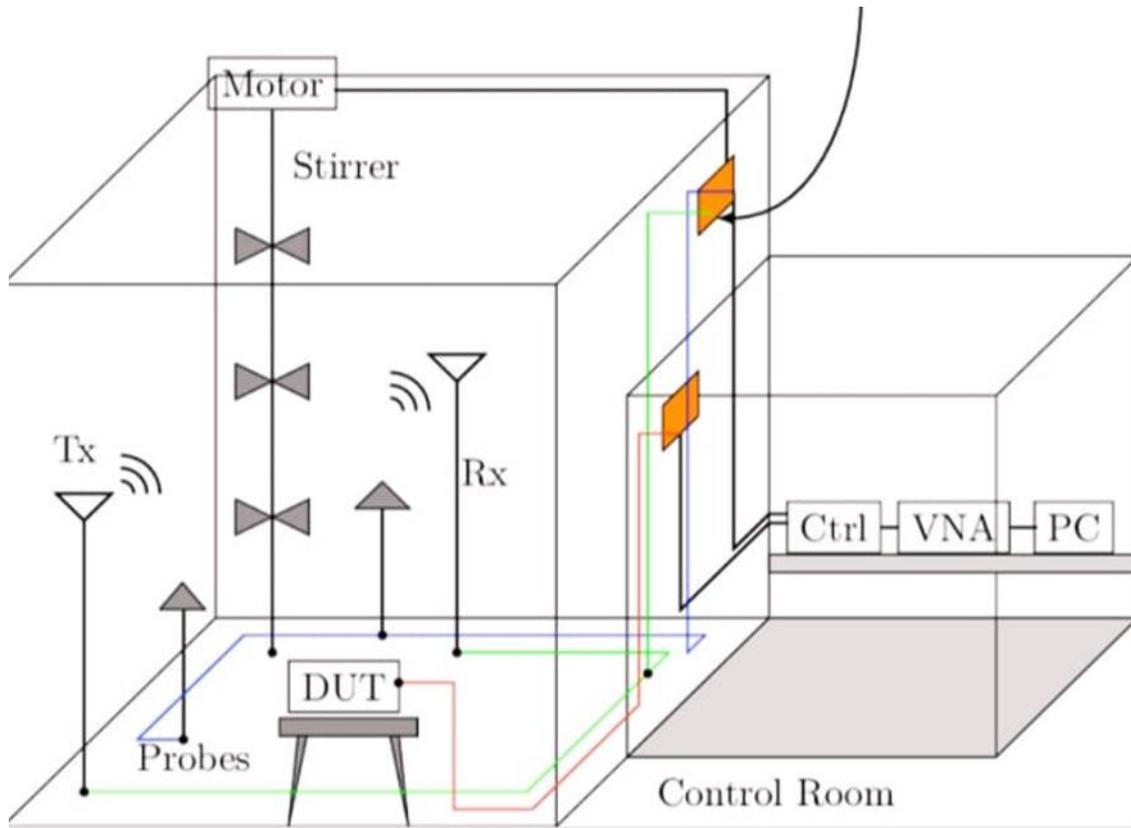


Fig 3: Magnetic Reverberating Coupling.

V. DISTANT FIELD METHOD

The distant field techniques are used for the measurements of load distant from the source of the power.

Here the distant field method has two types of methods. These methods are used to high power transmission.

The two methods are infrared wave power transmission method and optical maser power transmission [10].

1) INFRARED WAVE POWER TRANSMISSION:

This method converts high power from the bottom station to the receiving station with two places in the visible horizon.

With the use of magnetron, the power can be obtained by the devices from the bottom stations with the help of satellites, receiving transmission etc.

It gives more efficiency but hard to focus light in short regions. This could be the easy method for power transmission. This conversion of electrical energy to infrared energy and this is compared to the antenna.

Here the alternating current (AC) cannot be diverted into infrared energy, so AC is converted into Direct Current first.

And the direct current (DC) is converted into infrared waves by using thermionic valve.

The transmitted or transferred waves are received at the antenna and sort out infrared waves into power which acts or gives more efficiency or it works efficiently.

Finally, the output is DC here and again the DC is converted into AC [11]

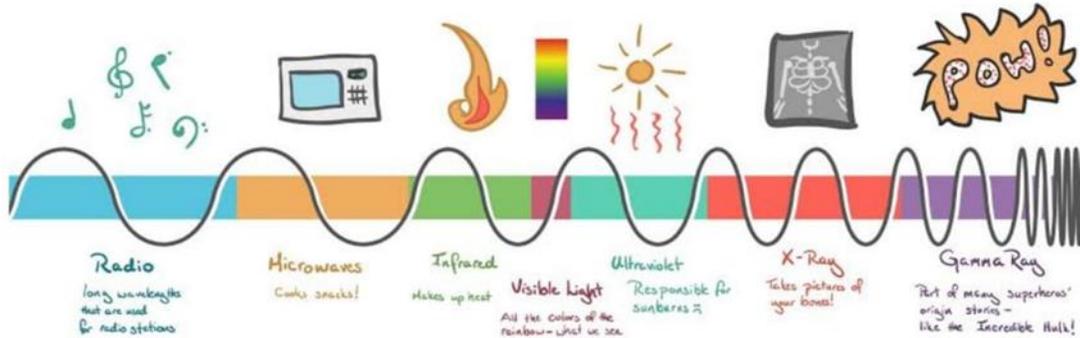


FIG: Infrared wave power transmission.

2) OPTICAL MASER POWER TRANSMISSION: this method deals with the use of mirror where energy is obtained at the compact areas.

This method also provides high power that are scattered. Now a days this method is also used widely.

To traverse the ice at the down of the moon where no light is present. This method is done where no sunlight or Sundays are present, if the light is present then the power transmission could not take place properly.

And then it is converted into electrical power. This power later converted into optical maser and then transfer to the rover playing at the down of the pan [2].

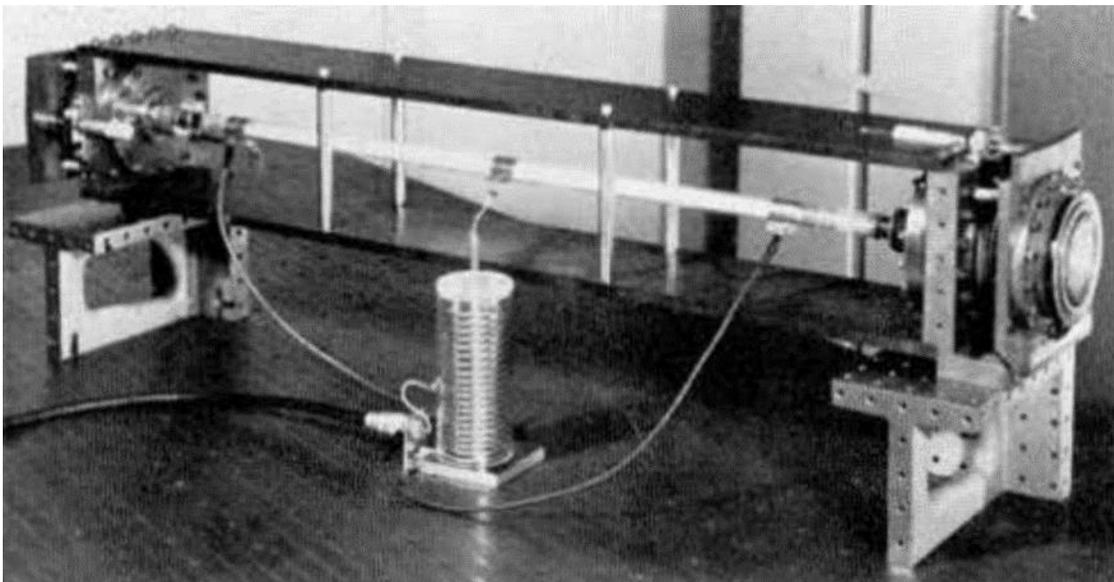


FIG: Optical Maser wave power transmission.

VI. IMPLEMENTATION OF WIRELESS POWER TRANSMISSION

The wireless power transmission has a great demand in the industries. This depends on the less energy objects that is wireless or contact less sensor or various mobile objects, with range of (less than 1W) and the more energy objects in the industrial field of area. The LED lights are connected to the load can be contact less energing and every object wants a cell or capacitor charge discuss contact less charging is of two kinds of developed systems [27].

A. IN THE ELECTRONIC FIELDS: In the field of electronics, the wireless power transfers the interval between the sending and receiving end, which plays a major role in the research and communication, this makes the guarantees the development of wireless power transmission in the day-to-day life of living beings.



FIG: Present usage of wireless power charging system.

The LED lights are connected to the resistor or load can be discuss direct contact less energing and various charging objects need a cell or capacitor charge and this divided into two types of developed systems [27].

B. BATTERY ELECTRICAL VEHICLES (BEVs): To adopt the electrical vehicles, the high-electric power should be developed thoroughly.

Infrastructure required for big-scale electric vehicles whether they are wired or wireless should be the perfect, available, reliable, useful, powerful, eligible for storage of energy, which is more required one for BEVs.

The charging of high power is the best way to reduce or decrease the electric vehicles again feeling amount of time which takes about 9 hours.

Most of the cases, it is proven that the system consumes or takes less cost than diesel and biodegradable and environmentally useful everywhere.

Development of these devices, wire power transmission is accepted everywhere. Mainly the large-scale industries are showing much more concentration in this area are gaining the more high-power systems.

The highest one is 22KVA and 92% of efficiency, 18.92KW to the battery of the vehicle or device.

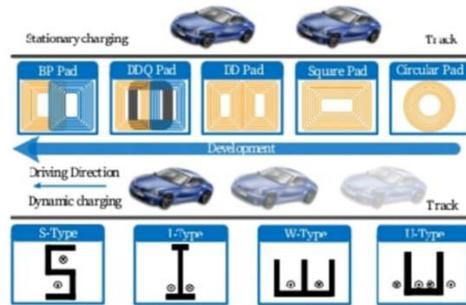


FIG: Battery Electric Vehicles.

C. BRONCHOSCOPE OBJECTS: The bronchoscope objects are used in the surgeries, heart operations, medical technology etc., and the replacement of primary cells for surgical for the body treatment.

The need of the wireless power transfer is more in the field of bronchoscope objects in the treatment of human body.

The drivelines can be neglected by the use of the wireless power transfer in the days as shown in the reference of [9], [17], and [27].



FIG: Bronchoscope object.

D. MITIGATION SYSTEMS: in the mitigation systems, the soldiers are provided with the vest which is contact less. This is developing the future in the mitigation systems by developing the technology of contact less power transfer.

The Talon tele robot is provided or equipped with the contact less charging so it can be charged again while migrating by van to whole area.

The other use is Helmet electronics where night view is included and radio objects that can be powered contact lessly from a cell set used by the soldiers vest.

The Automotive Engineers are having an association in development of wireless charging of electric and manmade electric vehicles or devices such as cars, vans and buses.

America, Japan etc., are already developed this kind if works. ICE and CEA i.e., consumer electronics association (CEA) and the international electro technical commission (IEC) [27].

This type of efforts are useful for habituation of wireless power methodology for the various wireless implementation field.

E. SOLAR ENERGY SPACE CAPSULE: This is the biggest implementation of wireless power transfer by the help of space capsule with sun arrays and keep them in the earth synchronous sphere.

The space capsule plays a vital role to produce or transmit power as infrared to the geo.

And the other best implementation of wireless power transfer is the wireless sensors and rectifying circuits (PARC) [2].

In order to design an application for transportation such as buses, cars, trains, etc., whatever it maybe there will be a loss like magnetic losses, core losses, energy losses, etc., keeping in the concentration of mind one should design or construct a system.

To transform energy or power properly, coupling or pairing should be larger than the higher couplers or pairs and low or less air differences.

Take any vehicle for example car, they will be pole of energy is given (40KW).

Switches and capacitors are used to two different intervals. In order to make the intervals same static chargers are used in this was agreed by the many factories or industries.

Many parties are come near to implement and invest the technique to get into force. It is already implemented.



FIG: Solar Energy Space Capsule.

CONCLUSION

The perspective of wireless power transfer is signified here.

Here, shown that the use of applications of the wireless power transfer which plays a beneficial role in the humans life.

There are some information about the wireless power transfer which is already discussed and going to implement in the near future.

There are many uses and advantages of wireless power transfer, the losses can be reduced, the time will be savaged, the time required to charge is less. The

equipment needed is low. So, this can be implemented by many countries in order to develop the technology.

More standards are in control of research about wireless power charging and in the field of robotics will be in day-to-day life uses only if wireless power maintain developing or improving.

The knowledge about this is strictly increased in the electric aspects, objects etc.

The high-frequency intervals high power changers or converters are will go on.

Solution for electrically energized transportation also decreases, the losses can be reduced by the use of wireless power transfer knowledge, technology can be developed a more, the equipment wanted also less. So, the wireless power transfer knowledge, technology can be developed a more, the equipment wanted also less. so, the wireless power transfer (WPT) plays a major role and it is need to implement or developed.

These days the implementation of HPWPT increased. It is used by the E-buses and BEVs. Where technology is usage and proceed the cost to be lessen of the developing of systems.

This will HPWPT mostly used in the parking places, public places, national highways, traffic signals etc.

So, with the use of couplers, the efficiency can be increased or developed, so that losses can be reduced.

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