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Review on Electrical Transmission Technology

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Abstract- I have put all the content in this research paper in such a way that after reading it all the doubt clear related to the electrical transmission technology. I have tried to give importance to most wireless transmission system in this particular system. Moreover, in this research paper the process of improving the power factor of the transmission line and I have also tried to find out how to transport electricity from one place to another by wire.

Keywords- Wireless Transmission, Optical Propagation, Wi Tricity, PMA Technology, Magnetic Resonant Coupling.

I. INTRODUCTION

In the transmission technology we are able to transfer energy from one source to the source by using many methods. And going forward, we will discuss all the methods Transmission is a process to sending some types of signals which are digital or analog. Transmission is classified in two manners one is the AC transmission and another is the DC transmission but transmission system is classified in one more way first one is the broadcast networks and the last one is the point to point networks.

In the old times, we used to bring energy from one place to another, but there was too much time and energy wasted in it. Because of this nowadays wireless transmission are very popular and this technology saves both time and energy.

II. OPTICAL PROPAGATION

Optical propagation Have two modes one is the multimode and second is single mode. They each mode works on different-different attenuation and time dispersion.

Single mode fiber cable provides more speed due to the lower attenuation. Optical fiber core has highly refractive region compare to the all the region. Optical cables constructed by glass, plastic and plastic- clad silica (PCS).

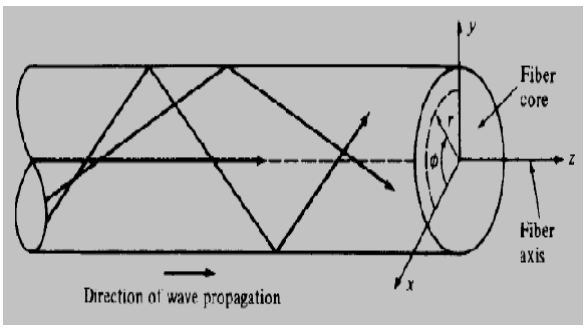

Fig 1. Rays propagation in fiber.

III. WIRELESS TRANSMISSION TECHNOLOGY

In the transmission of wireless energy, its simply means energy transmitted one source to another receiver by without any solid path its transmitted by air.Inductive power transfer, also known as wireless power transmission, can be used over short or long distances without the usage of wires. In comparison to prior technologies, this technology is efficient, quick, and low-maintenance.It also allows portable electronics to charge without ever needing to be plugged into a standard power outlet.

In comparison to wired electrical transmission, however, this method has a relatively low power loss. Wireless power transfer's main purpose is to allow electrical equipment to be continuously charged without the need for a power cord.Microwaves, resonance, and solar cells are the three basic systems employed in WPT.

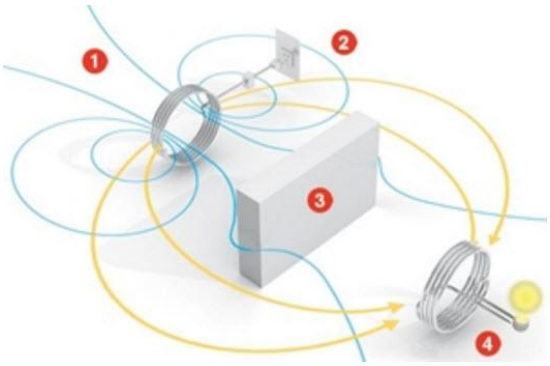

Fig 2. Wireless power transfer technology.

Electromagnetic radiation would be transmitted from a power source to a receiver in an electrical device using microwaves. Nikola Tesla, thefather of AC power, was the first to experiment with WPT. His concept was based on the premise that the earth itself is a conductor capable of carrying a charge across its entire surface.

While Tesla's experiments did not produce electricity, they did transport it, and his concepts can be used to address our current energy dilemma. Each application has its own set of disadvantages, but they all have the ability to help the earth in its desperate need for a new way to generate energy.

Portable technology is become an integral element of daily life. However, portability brings with it a new challenge: energy. Almost all portable devices are battery-powered, which means they will ultimately need to be recharged using the existing cable chargers.Instead of having to charge a cell phone, PDA, digital camera, voice recorder, mp3 player, or laptop by plugging it in, it might now be charged wirelessly.

Although wireless power transfer is viable and beneficial to people's daily lives, it has significant limitations, including the need for a network of hundreds of satellites and interference with other electronic devices. The near-field technique and the far-field approach are the two types of wireless power transfer techniques.

Far-field approaches, on the other hand, give lower frequency transmission with simple pattern measurements, and near-field approachesprovide greater frequency transmission with complete pattern measurements.

Electricity generates a source by any generator and power source. And the power receiver in space by any receiver device. And the receiver through to the electricity for the electrical load. This process increasing the convenience, reliability and safety purposes.

IV. METHODS OF WIRELESS TRANSMISSION OF ELECTRICITY

1. Induction:
The principle of mutual induction is the two coils placed in manage field when current passes through the one coil then by the inductive principle current generate in another coil due to some magnetic properties. These inductions simplest example of how mutual induction works in an AC motor, transformer etc. where these is no primary and secondarycoils [1].Wireless power uses the same fields and waves as wireless communication.

2. Electrodynamic Induction:
The phenomenon of electromagnetic induction can be demonstrated by an experiment. Wind an instructed copper wire on a paper or wooden cylinder so as to from a coil in the form of a solenoid. Connect the two ends of the coil to a galvanometer and a place a magnet close to it the reading of the galvanometer is zero where the magnet is stationary. The pointer of the galvanometer deflects towards the right when the north pole of the magnet is moved towards the solenoid.

The galvanometer shows zero reading when the motion of the magnet stops. This proves that as long as the magnet, current flows in the solenoid. If the magnet is moved away from the solenoid current flows in opposite direction in the solenoid. Thus, the galvanometer deflects towards the left.

The deflection increases if the magnet is moved away with greater velocity. If the polarity of the magnet is reversed and the magnet is brought close to the solenoid, then current flows in an opposite direction. The galvanometer accordingly turns towards the left.

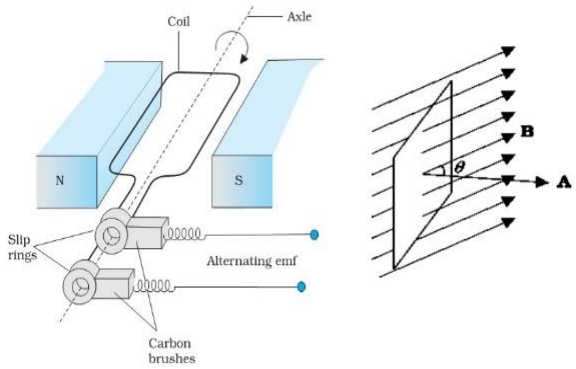

Fig 3. Electrodynamic Induction.

Faraday observed that current flows in the coil, only when there is a relative motion between the coil and the magnet. The direction of deflection in the galvanometer is reversed if the direction of motion is reversed.

Factors leading to increased current in the coil
- By using a strong magnet
- Increasing the motion of the motion
- Increasing the area of the number of turns of the coils

3. Radio:
Anyone has a device capable of receiving the data through this media. An unguided signal travels from the source to destination in several ways like electromagnetic spectrum, ground wave propagation and sky propagation, line sight propagation. Electromagnetic waves ranging in frequencies between 3KHZ to 1GHZ are called radio waves.

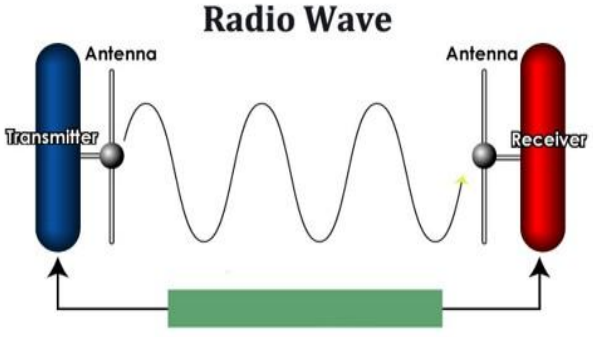

Fig 4. Radio Wave Model.

Omni directional, propagate in all directions so sending and receiving antennas do not have to be aligned and the radios within the broadcast area. Radio wave propagates in the sky mode travel long distance making it a good candidate for long distance broadcasting. And it is easy to generate, used for low data rate.

Application for radio- multicasting (1 sender many receiver), AM and FM radio, television, cordless phones.

4. Inductive Coupling:

Inductive coupling is defined as the coupling of two LC circuits with the same resonant frequency. It works by utilizing magnetic field induction, which is a natural part of current movement through wire. For instance, alternating current in a primary coil connected to a source can produce a varying magnetic field that induces a voltage across the terminals of a secondary coil at the secondary coil's terminals. In inductive coupling, the primary and secondary coils are two separate coils. Each of them was connected wirelessly, and inductive coupling has become a common technology for transferring electricity without wires due to its simplicity, convenience, and safety.

Various types of electrical deviceshave previously were created using this technological application. As a result, it's been successfully marketed in a variety of goods, including an electric toothbrush, a cell phone or laptop charging pad, and medical implants. When two coils are steadily separated from each other if their alignment is not ideal in inductive coupling, power transfer steadily declines.

These kinds of issues usually emerge when it isn't used carefully. It works best when the device's charging node and power receiving node are in close proximity, usually less than a coil diameter; for example, the range can be measured in centimeters, and the charging direction must be aligned.

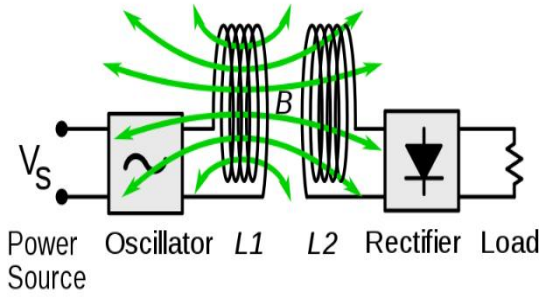

Fig 5. Inductive Coupling.

5. Magnetic Resonant Coupling:

Magnetic resonant coupling is the last and most important category of WPT technology in the part of near field approaches. Because of the combination of inductive coupling and resonance, Kurs et al. invented this technology, which allows for extremely powerful interactions between two separate objects. Furthermore, energy will be transferred between the magnetic field around the coil and the electric field surrounding the capacitor. The phenomenon of magnetic resonance is akin to that of classical mechanical resonance, in which a string tuned to a specific tone can be driven to vibration by a faraway sound source if their resonance frequencies match.

Energy can be efficiently transferred from a source coil to a receiver coil with little energy loss due to alternating current in a primary coil (connected to a source) generates a varying magnetic field that induces a voltage across the terminals of asecondary coil at the receiver in this technology.

A good extraneous off-resonant object is an electrical transformer. When compared to inductive coupling, this technique has various advantages, including being very efficient, having little radiation loss, and having a far longer range and directional capability [1] [2] [3].
Microwave Power Transmission With two points in line of sight, this technique transmits strong power from the base station to the receiving station or mobile devices. This technology uses geosynchronous receiving and transmitting satellites to allow items to obtain power from the base station via the magnetron.

MPT is efficient in converting energy, although it is a little difficult to focus the beam in a tiny area. Furthermore, this technology might readily move through the atmosphere. The initial stage in power transmission is to transform electrical energy into microwave energy, which is then captured using a rectenna. Alternating Current (AC) cannot be directly converted to microwave energy in this technology.

As a result, AC must first be converted to Direct Current (DC), and then DC must be turned to microwaves through magnetrons. Rectennas receive transmitted waves and then convert microwaves into electricity more effectively. As a result, the output will be DC. The DC will then be converted back to AC in the last stage [4] [5-8].

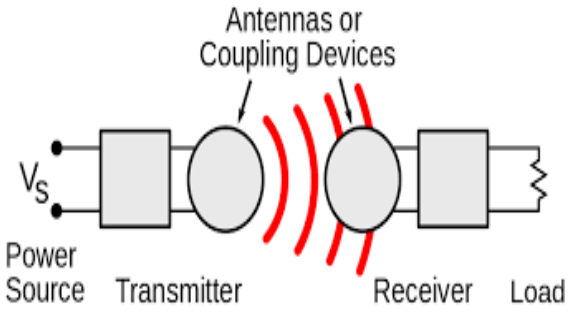

Fig 6. Microwave power transmission.

6. Laser Power Transmission:
This technology is slightly different from MPT in that it uses a mirror to focus power in a limited region. This technology also generates high, coherent, and non-dispersed powers. Laser technology, on the other hand, suffers from attenuation when it travels through the atmosphere.

Furthermore, this technology was applied to a rover to investigate the presence of ice in the bottom of lunar craters where no sunlight is available. The solar energy generated by the radiation, on the other hand, is turned into electric energy. The energy will subsequently be converted to laser light and transferred to the rover working at the crater's bottom [9] [10].

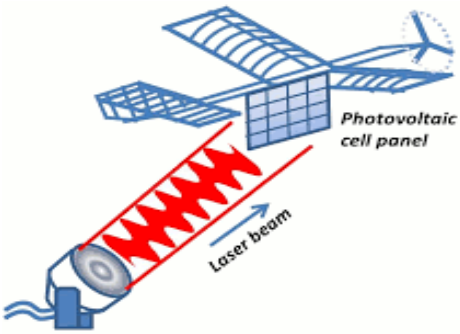

Fig 7. Laser Power Transmission.

V. NEW IDEAS AND EXPERIMENTS

1. WiTricity
The new technology called WiTricity is based on using coupled resonant objects.

In 1897 Nikola tesla pioneer of induction technique had a vision for "WORD wireless system". A 187 feet tall tower was built to broadcast energy so that all people can have access to free energy he managed to light 200 lamps from a distance of 40km.WPT have two methods first is inductive coupling and second is resonant inductive coupling and the WiTricity is based on the resonant inductive coupling. Resonance inductive coupling is a combination of inductive coupling and resonance.

Advantage of wireless electricity is no wire, no E-waste, need for battery is eliminated, efficient energy transfer using kit, maintenance cost is loss. Disadvantage of wireless electricity is distance constraint, field strength has to be under safety levels, and initial cost is high.

2. Intel's Demonstration:
Intel revealed a fascinating technique that could eliminate the need for power connections, chargers, and batteries. During yesterday's Intel Developer Forum, the chipmaker, Developer Forum (IDF), remotely powered a device.
From three feet away, a 60-watt light globe with a 75 percent efficiencythe technology works by creating resonancebetween two magnetic fields, known as a "resonant induction" phenomenon. Intel hopes to one day use the technology topower laptops and other portable devices, either directly via atransmitter or by charging internal super capacitors which can be rapidly recharged. The research project at Intel, led byJoshua R. Smith aims to build upon this work.

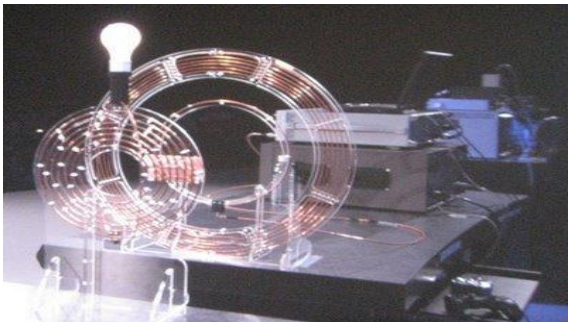

Fig 8. Experiment at INTEL for WPT.

While testing a high-frequency transformer, Lightning Lab unintentionally transferred a considerable amount of energy.During the test, the Nevada Lightning Laboratory witnessed another transformer across the facility begin to "smoke profusely." They discovered that the transformer had been physically unplugged from its power source and set out to figure out what had gone wrong.

They observed that even widely spread coils could wirelessly transmit enormous quantities of power, so they set up a board of twenty 40W light globes with the transmitter and receiver 5 meters (16.4 feet) apart to try it out.The biggest disadvantage, as with other wireless power transmissions, is the amount of energy lost in the process. For the receiver to collect the 800W, the transmitting coil had to run at 3.6KW, which is wasteful.

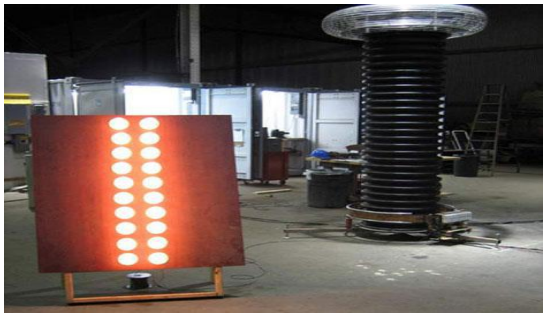

Fig 9. Lightening lab experiment.

3. Qi Technology:
Small inductors are used in this technique to carry power over higher frequencies while also allowing for a charging distance of only a few centimetres at most. As a result, to avoid a lack of a substantial magnetic field, portable devices must be put very precisely on the dock.

Qi components can use several resonator arrays to generate a greater charging area because to its limited charging area. Individual coils switched on, on the other hand, do not reduce the problem and even waste a lot of power. Users must line their gadgets exactly with the magnetic fields in order to maintain a strong enough connection. Due to the operating frequency heating conductive materials, the wireless charger might get heated during charging and heat up the back of a device.

A limited communication protocol is also included in the Qi standard to restrict the amount of power consumed by many coils.The receiving device can tell the charger how much power it needs and when it is fully charged using this method. The charger can also change the power output to suit any receiving devices and go into standby mode once the device is fully charged or if no device is connected. Despite the fact that a wireless charger is not as efficient as a traditional charger, the Qi standard will soon be able to be used in wireless charging [11][12] [13-16].

4. PMA Technology:
Power Matters Alliance is another new technology (PMA). This is the organisation that has been working with a collection of research group leaders to develop a better power paradigm for battery-equipped devices employing wireless charging technology in a global, not-for-profit industry.Since its inception in 2012, PMA has developed at a quick pace.

More than 100 members from a variety of industries, including telecommunications, consumer products, automotive, retail, furniture, surfaces, and others, have just begun to engage with this new technology standard. PMA's development and success may be due to a unique approach to making wireless charging widespread in the places where customers need it the most, as well as members' hard work and dedication [17].

VI. APPLICATION OF ELECTRICAL TRANSMISSION TECHNOLOGY

The distance between transmitter and receiver in the field of wireless power transmission, which is expected to be great in the focus of recent research, can make the dream come true in a variety of applications in human existence. Low-power devices, such as wireless sensors or other electronic mobile devices, with a power range of less than 1W, and high-powered devices in the industrial field with a power range of more than 1W, are used in many applications (not more than 3KW).
Direct wireless powering can be defined as products like led lights where the energy source is directly connected to the load, and different charging devices need to be battery or capacitor charge defined wireless charging could be two types of implemented system.

1. Field of Electronics:
Wireless charging systems are being used in electrical items such as laptops by using a wireless power source positioned behind the corkboard, which is the main application field for wireless charging systems. This device has the capability of delivering more than 20 watts of power. It can also charge up to 40 cm away from the wireless charging source [21].

2. Medical Devices:
Implanted medical equipment such as LVAD cardiac assist pumps, pacemakers, and infusion pumps have all benefited from wireless power transmission. The electricity can be efficiently delivered to medical equipment profoundly implanted within the human body utilizing this technique.It can also help to eliminate the requirement for drivelines that penetrate the human body and surgical primary battery replacement [19][18][20][21].

3. LED Lighting:
We can directly charge our devices utilizing wireless electricity by using wireless power transfer in LED (light emitting diode) lights, which eliminates the need for batteries in under-cabinet task lighting. It can also assist architectural lighting designers in creating goods that appear to float in mid-air and require no power cord [21].

4. Electric Vehicles:
Wireless charging systems can immediately power rechargeable hybrid and battery electric automobiles. Over a distance of 20 cm, these devices deliver 3.3 kW with remarkable efficiency. This technique allows for the reliable and efficient delivery of power to electric vehicles without the use of wires.Furthermore, wireless charging is predicted to dramatically improve the charging experience for EV owners, making these vehicles even more appealing to consumers [21].

VII. FUTURE ASPECTS

1. Power-Generating Solar Satellite Inhabitant:
Japan intends to employ space-based wireless energy to power three million homes. They intend to launch a solar-panel-equipped satellite into space that will be able to transmit a gigawatt-strong stream of power back to Earth wirelessly.

In 2015, a small test model will be released. It will take three decades to smooth out all the bugs and put up a fully functional system. Dealing with the potential risks if a 1-gigawatt microwave beam directed at a small location on Earth misses its goal is likely a huge problem. Mitsubishi and designer IHI (together with research teams from 14 other countries) have just announced their support for the $21 billion project.

Fig 10. Japan's wireless, power-generating, solar satellite inhabitant.

VIII. CONCLUSION

A wireless power transmission concept is offered. Recent technology applications that make human life in the modern world more useful have been examined. Three new wireless power technology standards that are already competing with one other are expected to be one of the hot topics in the near future as more standards emerge.

Among these three wireless charging standards, which will emerge victorious in a race defined by their recent great applications? According to the comparison table, A4WP standards, which have a big magnetic field and a long charging distance, must stay ahead of other standards in terms of technology, but Qi and PMA are also improving at a rapid pace. Solar power satellites are the way of the future for non-conventional energy delivery. The many methods and aspects of wireless electrical power transfer are examined. The evolution of technology since Tesla's time has been examined.

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