e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:03/Issue:09/September-2021 Impact Factor- 6.752 www.irjmets.com

WIRELESS ENERGY TRANSMISSION

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ABSTRACT

MPT wireless transmission of high energy power in microwave waves from one place to another. Attempts to transfer electricity were introduced more than a century ago. But the most exciting developments in the transmission of electricity were made during the first century, which actually began two decades ago. For the past decade, out-of-field power transmission has improved and now products containing wireless charging are on sale, albeit at a more expensive cost. In this decade, with the explosion of IoT devices, the transmission of long-distance electricity transmission is bound to increase. It will help us reduce the number of calls from our homes and imagine that your phone starts charging the moment you enter your house. The next phase will completely remove the battery from the phones but that tomorrow is yet to be in our grasp. The WET study is largely driven by the desire to remotely control Unmanned Aerial Vehicles (UAV's). This happens under wireless power, but if we need to transmit the energy over long distances, we have to use a power generation technology. By performing beamforming, we can transfer a sufficient amount of energy to drones which are operating at the heights of 35000 – 45000 feet, without batteries in them or one day to harvest an energy from our nearest star and send it to earth without a need of wired infrastructure to transfer the energy.

I. INTRODUCTION

WPT (WPT) or wireless energy transmission is wireless transmission of energy. In this type of power transmission system, the transmitter which is powered by a source of energy from a power source which is located at a distance, creates a time-varying electric field which in turn transfers the power across the space to the receiving-end. Power transmission technology can create an alternative way for the more traditional use of wires and batteries, which can further increase the mobility, easiness while actual use, and the overall safety of the general-electric motors for all applications of the wireless energy transmission. Wireless power transfers assist in the management of power transmission when the connecting cables of traditional power supply are malfunctioning, dangerous, or impossible to reinstate. Wireless energy transmission is mainly divided into two categories, adjacent field (Near-field) and the remote field (Far-field). In a nearby field or in nonlinear systems, the energy is transferred to a short distance with the help of magnetic field's inconsistent interactions between telephone coils, or with the help of electric fields generated using a capacitive interaction between metal electrodes. Inductive integration is the well-known Wi-Fi technology in a use in the current market. It's use includes recharging of portable devices such as telephones and toothbrushes, RFID tags, input cookies, wireless charging, or offline power transmission to medical devices that can be installed such as artificial heart chemicals or vehicles which run on electricity.

II. LITERATURE SURVEY

- N. Tesla, "The transmission of electric energy without wires", Proc. 13th Anniversary Number Elect. World Eng., Mar. 5, 1904.
- S. Kitazawa, M. Hanazawa, S. Ano, H. Kamoda, H. Ban and K. Kobayashi, "Field test results of RF energy harvesting from cellular base station", Proc. 6th Global Symp. Millimeter-Waves, 2013.
- W. C. Brown, "Optimization of the efficiency and other properties of the rectenna element", Proc. MTT- S Int. Microw. Symp., pp. 142-144, 1976.
- J. O. L McSpadden, Fan and K. Chang, "Design and experiments of a high-conversion-efficiency 5.8-GHz rectenna", IEEE Trans. Microw. Theory Techn., vol. 46, no. 12, pp. 2053-2060, Dec. 1998.Y. Tanaka et al., "A study of received power in distributed wireless power transfer system", Proc. IEEE AP-S/URSI, 2020.
- W. C. Brown, "The history of power transmission by radio waves", IEEE Trans. Microw. Theory Techn., vol. 32, no. 9, pp. 1230-1242, Sep. 1984.

- W. C. Brown, "Status of the microwave power transmission components for solar power satellite", IEEE Trans. Microw. Theory Techn., vol. 29, no. 12, pp. 1319-1327, Dec. 1981.

III. WET TECHNOLOGY

WPT technology is old technology and was demonstrated by "Nikola Tesla" in the 1980s. Wireless energy transmission mainly uses three main mechanisms such as microwaves, solar cells, and ground recitation. Microwaves are used in an electrical device to transmit electrical radiation from the source to end-receivers. The term WET correctly states that electrical energy can be transmitted from the source to the device without the need for wires. Basically, it includes two coils, one the transmitting coil and the other as the receiving coil. When the transmission coil is powered by the AC current to generate a sustainable magnetic field, it also attracts the energy of the receiver coil. The basics of wireless transmission include inductive power that can be transmitted from one coil to another coil through a sustainable energy field. Currently the DC power source for the current provided by coil is transformed into a high-frequency AC current with an electron built specifically for the transmitter.

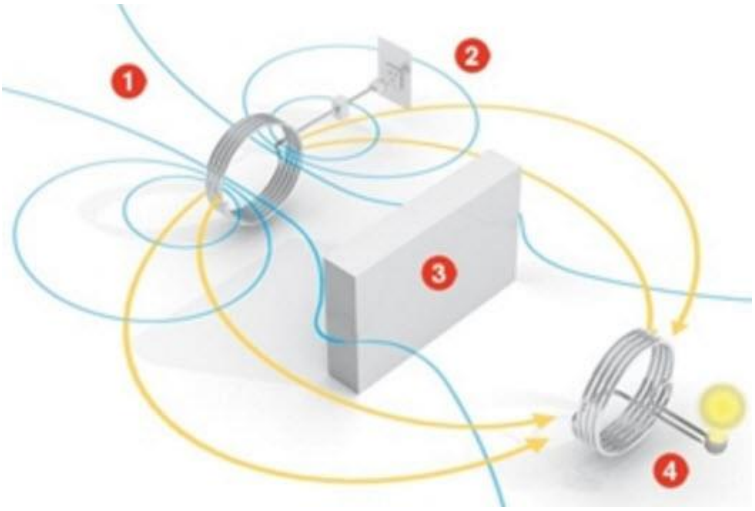

Figure 1: 3D view of DC provided.

In the TX (transmitter) phase, the AC current raises a copper wire, which creates a sustainable energy field. If the RX (Receiver) coil is located near the energy field, then the energy field can generate AC power on the receiving-end of the coil. Electron-practical which are acquired into these devices convert the AC current back to the DC current, which in turn becomes operational.

Wireless Energy Transmission Circuit:

A simple circuit used for the transfer of electricity is shown below. The requirements for this region mainly include 20-30 magnets (copper gauge), 1-battery, transistor (2N2222) and LED. The assembly of this district consists of a transfer and acceptance.

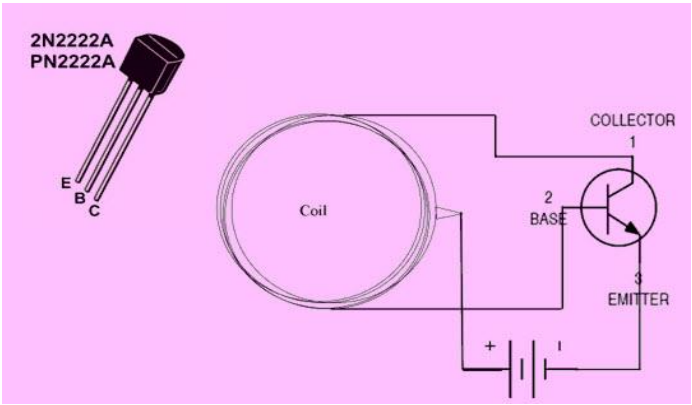

Figure 2: transistor (2N2222)

e-ISSN: 2582-5208
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Transmitter:

Take a PVC pipe and wire it seven times after rotating the wire about three inches into the last center loop and continue the process. Now take transistor 2N2222 and connect its base terminal to one cease of the copper coil, the collector terminal to the alternative stop of the copper coil, and now join the emitter terminal to the opposite end (-ve) AA battery terminal. The coil's center terminal will be in direct contact with the positive (+ ve) side of the traditional AA type battery. When the coil is inserted one inch above the transmission coil, this will signal with the flash of indicator LED.

Far-field Wireless Energy Transmission Circuit:

Remote field routes reach long distances, often for miles, when the distance between receiver and the transmitter is greater than that of the total width of the devices which are used. High-directional horns or a well-included laser mild produce a beam of strength that can be made to mimic the composition of the received area. The upper orientation of the antennas is bodily constrained through contrast.

In popular, visible light (from lasers) and microwaves (from antennas designed for the cause) are styles of electromagnetic radiation suitable for energy transmission.

The length of the material can be determined via the space from the transmitter to the receiver, the restrict period, and the Rayleigh system or distribution restriction, used inside the usual production of a radio antenna, which works on lasers. Airey's distribution restriction is likewise frequently used to determine the scale of a nearby region within a simple distance from the open. Electromagnetic radiation encounters small separation at brief wavelengths (high waves); consequently, as an instance, the blue laser is subdivided through extraordinary colorings of various wavelengths.

Long Distance Wireless Power Grid:

Microwaves travel around the earth twice - all the way ~ 200km.

If you use a high-power line, the route can be of long distance - a more natural effect.

λ = 5000km @ 60Hz - power cord becomes a good antenna over long distances.

A long-distance is usually a power transmission of 100 meters or kilometers as a whole. Another method of transmitting energy is using antennas to transmit electric shocks (microwaves or lasers).

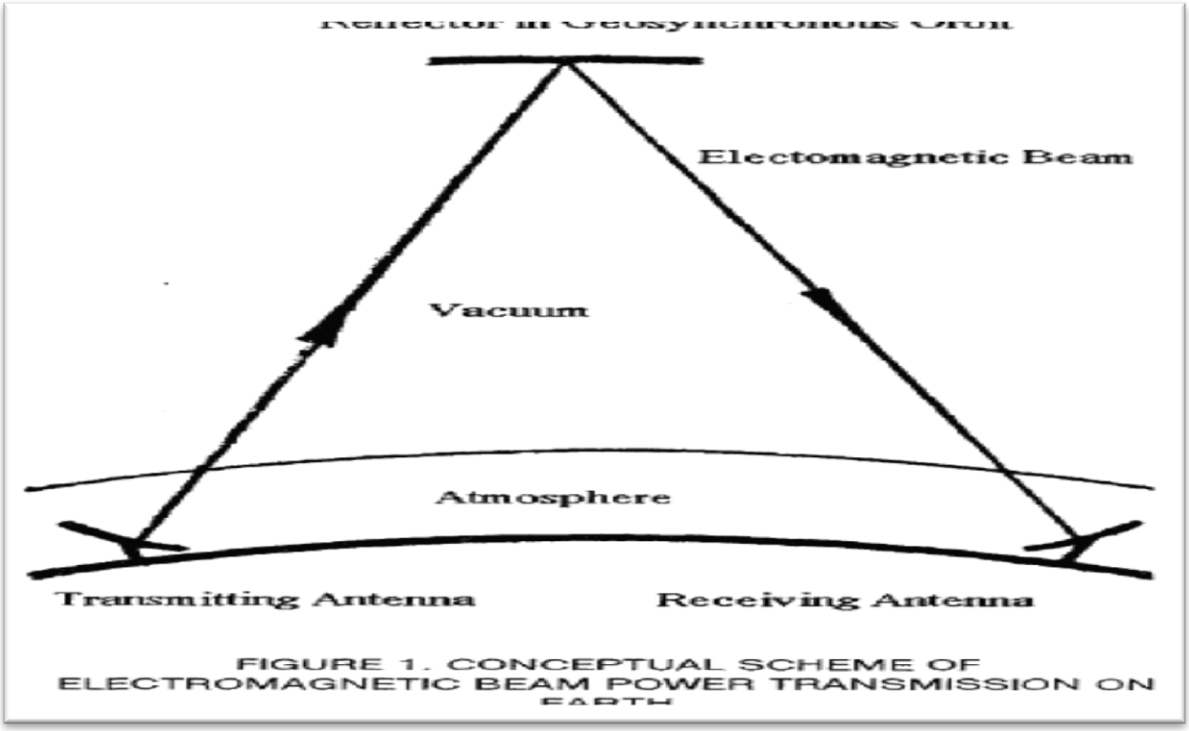

Figure 3: Wireless Power transmission.

From Far-Field WPT to Near-Field WPT:

- Far-field WPT has limitations but has applications
- Very low power devices or sensor networks, where efficiency and safety are not a big concern.
- A space for high power, military, or industry which are not cost-effective.
- However, when it comes to consumer applications such as charging mobile phones, laptops, and other electronic devices, or electric vehicles, the WPT remote field is not suitable for efficiency and safety.
- WPT near the field is a better option.
- A low magnetic field is placed to allow for equal force density of a higher plane.
- The default USB charger connector is the solution, still connected through connectors/chargers.

Near-field WPT:

- Inductive Coupling Technology
- It makes us want Far-Field WPT even more!
- Magnetic fusion and low safety concerns
- High efficiency has a remote field
- Electronic frequency and high efficiency
- Field near or non-radiation - This refers to the total area within the 1 wavelength (λ) of the source antenna. In this area of the electric fields and the energy fields are different and the energy can be transmitted through conductive fields by welding (electrostatic induction) between sustainable electrodes, or by magnetic field by wiring (electrical induction) between telephone coils. If no device is found or absorbed within its range, then there is no power is left on the transmitter to transmit.

Types of Near-Field Energy Transmission:

- Magnetic resonance
- Magnetic field
- Four coils
- Inductive Coupling

Inductive coupling:

In power connections (power input or energy transmission, IPT), electricity is transmitted among cellphone coils by way of magnetic force. The transmitter and receiver coil collectively shape a transformer (see diagram). The modern-day alternate (AC) using the transmission coil (L1) forms a flexible magnetic field (B) utilizing the Ampere law. The magnetic area passes thru the receiving coil (L2), wherein it draws any other EMF (voltage) through the Faraday induction law, which generates trade electricity for the receiver. In the period in-between, the ensuing transfer can force the weight directly, or be adjusted to direct contemporary (DC) thru the clear out on the receiver, which drives the load. A few systems, including electric powered toothbrush stands, perform at 50/60 Hz so AC mains are used at once at the transmission coil, however, in maximum structures, an electric oscillator creates a high-frequency AC drive on the coil due to the fact top transmission normally improves.

Inductive integration is the oldest and most broadly used wi-fi energy generation and is probably the best one utilized in commercial products. It is used for wireless charging gadgets utilized in wet regions along with electric-powered toothbrushes and shaving, to reduce the threat of electric surprise. Another location of software is to re-insert the "implants" of implanted gadgets that are implanted inside the human frame, consisting of cardiovascular chemical compounds and insulin pumps, to keep away from having strands passing through the skin. It is also used to fee electric vehicles including cars and to charge or shipping cars along with buses and trains.

However, the fastest-growing use of wi-fi charging packs is to upgrade transportable and transportable wireless gadgets consisting of laptops and drugs, laptop mice, cellular telephones, digital media players, and video game controls. [citation needed] In America, the Federal Communications Commission (FCC) issued its first wireless charging gadget certificates in December 2017.

The transmitted energy increases with frequency and mutual inductance between the coils, relying on their geometry and the distance among them. The most commonly used eligibility fee is the integration coefficient.

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This measurable parameter is identical to the fraction of the magnetic flux thru the transmitter coil L1 passing thru the receiver coil L2 when L2 grows to become on. If both coils are within the identical axis and are near together then all the magnetic field from L1 exceeds L2, ok = 1 and the efficiency of the hyperlink is near a hundred%. The more the distinction among the coils, the magnetic discipline from the primary coil misses the second one, and the decrease ok and the efficiency of the hyperlink technique to 0 by means of greater separation. The efficiency of the connector and the transmitted power is approximately identical to okay ^ 2 To attain the most efficiency, the coils ought to be very near collectively, a fraction of the width of the coil, the frequency within inches, and the coil's ribs aligned. An extensive range of coil shapes is often used, to grow compaction. Ferrite middle's "flux confinement" can block magnetic energy, improve concord and decrease interference in nearby electronics, however, are tougher and extra powerful for small wireless gadgets that often use air coils.

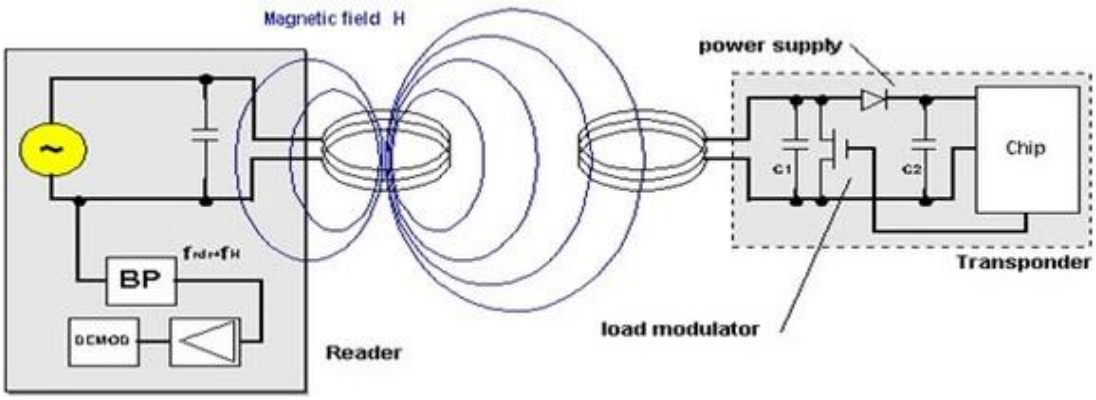

Figure 4: Inductive Coupling.

Normal incoming interactions can handiest acquire maximum overall performance whilst the coils are very near, commonly very nearby. In most cutting-edge parts the connection reduction (defined beneath) is used, in which performance is multiplied through resonant circuits. This can reap better efficiency at extra distances than inductive resonant coupling.

Flexibility of Wireless Energy Transmission:

- Inductive coupling to replace power has been around for pretty a few years. The rechargeable electric toothbrush is an example.
- The wireless strength transfer is an everyday term for some special technology for transmitting strength by electromagnetic fields.
- In elegant, a wireless strength machine includes a "transmitter" device connected to a delivery of power which incorporates a mains power line, which converts the electricity to a time-various electromagnetic field, and one or greater "receiver" gadgets which get hold of the power and convert it returned to DC or AC electric present-day that is utilized by an electrical load.
- The scientific and carried out problems discussed in this paper are associated with the development of a wi-fi charging station the usage of an inductive power transfer (IPT) module electricity supply with strength dosing and dynamic matching.
- A pc simulation and an experimental examination allowed the authors to define the tiers of the parameter variant of the same load and to design the high-quality matching so that most electricity switch is efficaciously completed.
- The proposed principle of energy control presents an exceptionally dependable and bendy charging station in spite of a simplified device of computerized manipulate and fault safety.
- A prototype charging station is advanced and constructed to deliver an inductive strength transfer system that can provide 30–35 kW energy over an air hole amongst transmitting and receiving factors measuring 50–two hundred mm and with a horizontal misalignment of ±2 hundred mm.

- The results confirmed that the device can transfer the desired electrical electricity with approximately 82%–92% performance and that the IPT module and its dynamic matching throughout charging exhibited an immoderate diploma of balance under a misaligned (x-y-z) circumstance and battery state of charge.
- During the final decade, almost all predominant vehicle companies have made studies and improvement contributions inside the field of electrical automobiles (EVs). One of the extensively mentioned issues is related to the charging of EVs with electric power. The focus is on battery potential and mileage without charging and infrastructure and charging time.
- Microscale systems that might integrate more than one functionalities, consisting of untethered motion, actuation, and conversation, can be of use in an expansion of packages from robotics to drug transport.
- However, the one's systems require each inflexible and bendy issue—which includes microelectronic circuits, engines, actuators, sensors, controllers, and power materials—to be included on an unmarried platform.
- Right right here, we record a flexible microsystem this is able to manage locomotion and actuation and is pushed by using the use of a wireless energy switch. The microsystem makes use of tube-fashioned catalytic micro-engines which may be associated with a flat polymeric structure.
- A rectangular coil is covered in the platform, which lets in wireless power transfer through inductive coupling. As a result, the catalytic engines can be locally heated and the path motion-managed.
- Our platform also can combine moderate-emitting diodes and a thermoresponsive micro-arm that can be used to carry out hold close and release obligations.
- Different options for wireless strength switch require specific device positioning on a pad or holder, very near proximity to (regularly resting directly on) the charging source, and the supply can definitely fee an unmarried tool with a single coil. Now, the engineers at WiTricity have leveraged the power of magnetic resonance to rethink those limitations.
- Their device, dubbed "notably resonant wireless power switch", is based totally on oscillating time-numerous magnetic fields generated by means of alternating current passing via a coil that talents as a strong source. A strength amplifier related to this supply coil controls the power stages and running frequency, riding the magnetic area degrees.

Figure 5,6: applications of wireless power transmission.

Real-life Applications of Flexibility of Wi-fi Charging Devices o:

1. Energy harvesting:

- Within the context of wireless energy, energy harvesting, additionally called strength harvesting or energy scavenging, is the conversion of ambient strength from the surroundings to electric powered electricity, in particular to energy small self-reliant wireless virtual devices.
- The ambient power may additionally come from stray electric powered or magnetic fields or radio waves from the close-by electric-powered systems, mild, thermal power (warmness), or kinetic energy collectively with vibration or movement of the device.
- This new generation is being developed to the area of the need for battery alternative or charging of such wireless gadgets, allowing them to perform completely autonomously.

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- Energy harvesters offer a totally small quantity of electricity for low-strength electronics. While the entering gas to 3 big-scale technology expenses property (oil, coal, and so forth.), the electricity supply for power harvesters is a present as ambient record. As an instance, temperature gradients exist from the operation of a combustion engine and in metropolis regions, there can also be an outsized quantity of electromagnetic strength in the environment due to radio and television broadcasting.
- One of the earliest packages of ambient energy gathered from ambient electromagnetic radiation (EMR) is the crystal radio.
- The principles of strength harvesting from ambient EMR may be tested with primary components.

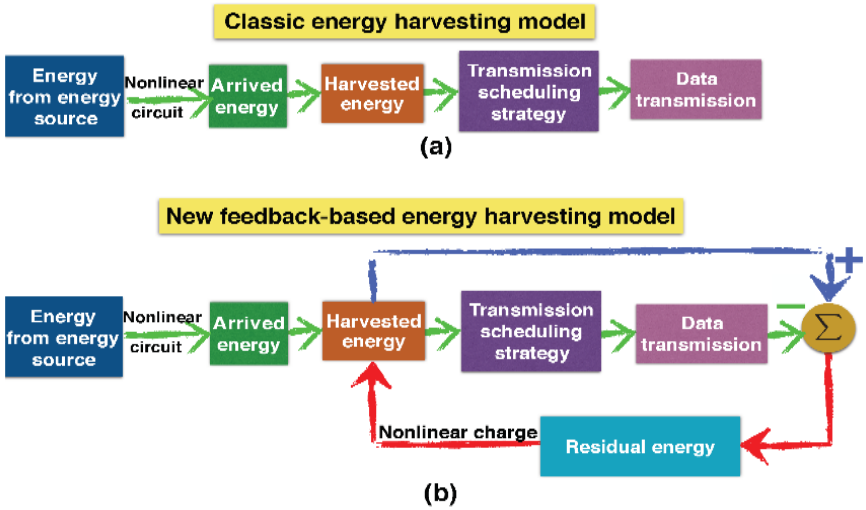

Figure 7: Energy Harvesting

IV. RESULTS AND DISCUSSION

- Far-field energy transmission
  - Long distance
  - Safety concern
  - Lower efficiency
  - Space/military, ultra-low power devices and sensor network, energy harvesting
- Near-field energy transmission
  - Short distance
  - Less safety concerns
  - Higher efficiency
  - Consumer applications

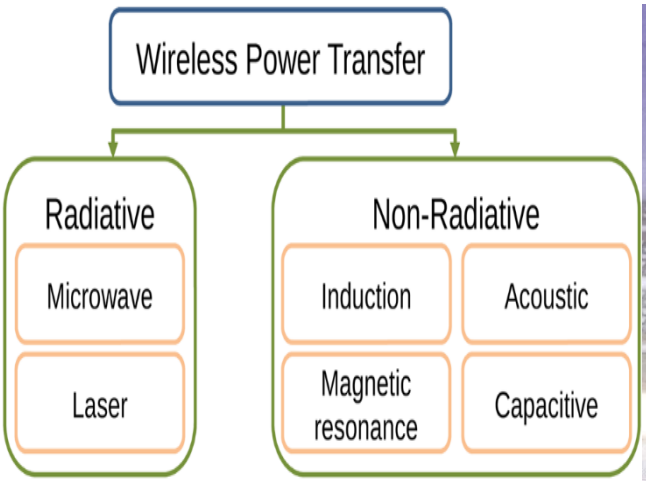

Figure 8: Overview of Wireless Energy Transmission.

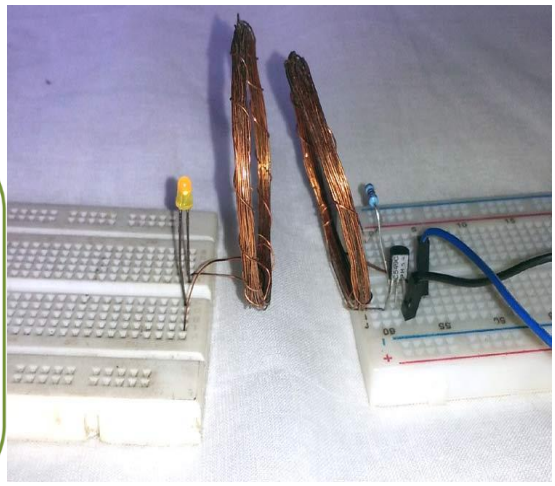

Figure 9: live practical example

Table 1. Performance Comparison of Wireless Power Transfer Methods

	Comparison Parameters				
WPT Methods	**Output Power**	**Distance**	**Cost**	**Efficiency**	**Biological Effects**
Magnetic Resonance	60 Watts [10]	Few Meters [10]	Inexpensive	Up to 45% [10]	No harmful effects [11]
Microwave	100 Kilowatts [12]	Few Kilometers [12]	Expensive	Up to 54% [12]	Damages living tissue [12]
Laser	Several hundred Kilowatts [13]	Few Kilometers [13]	Expensive	Up to 30% [13]	Damages living tissue [13]

V. CONCLUSION

- Wi-fi power transfer (WPT), wi-fi strength transmission, wi-fi electricity Transmission (wet), or electromagnetic electricity switch is the transmission of electrical power without wires as a bodily hyperlink. Wireless electricity switch is a longtime term for some of the only-of-a-type technologies for transmitting strength via using electromagnetic fields.
- Wi-fi power transfer has the functionality to change this planet on so many wonderful ranges. The most commercially viable utility bobbing up to counter the consequences of global warming and the growing name for strength is WPT thru microwave transmission from the location.
- In the electromagnetic induction-type wireless strength transmission, the magnetic area distribution according to the relative positions of the transmit and get hold of coils and the strength transmission overall performance will be very critical.

VI. REFERENCES

[1] V. Talla, B. Kellogg, S. Gollakota and J. R. Smith, "Battery-free cellphone", Proc. ACM Interact. Mobile Wearable Ubiquitous Technol., 2017.

[2] N. Shinohara, "Wireless power transfer in Japan: Regulations and activities", Proc. 14th Eur. Conf. Antenna Propag., 2020.

[3] V. Manev, H. Visser, P. Baltus and H. Gao, "A comparison of tunnel diode and Schottky diode in rectifier at 2.4 GHz for low input power region", Proc. IEEE Wireless Power Week, 2019.

[4] C. Song et al., "Matching network elimination in broadband rectennas for high-efficiency wireless power transfer and energy harvesting", IEEE Trans. Ind. Electron., vol. 64, no. 5, pp. 3950-3961, May 2017.

[5] S. Mihara et al., "The result of ground experiment of microwave wireless power transmission", Proc. 66th Int. Astronaut. Congr., 2015.

[6] T. Hirakawa, C. Wang and N. Shinohara, "RF-DC conversion efficiency improvement for microwave transmission with pulse modulation", Proc. Cambridge J. Wireless Power Transfer, Mar. 2019.

[7] S. Karimulla and K. Ravi, A review on importance of smart grid in electrical power system, presented at 2019 Int. Conf. Computation of Power, Energy, Information and Communication (ICCPEIC), Chennai, India, 2019, pp. 22– 27.

[8] E. Spano, L. Niccolini, S. Di Pascoli, and G. ` Iannacconeluca, Last-meter smart grid embedded in an internet-of-things platform, IEEE Trans. Smart Grid, vol. 6, no. 1, pp. 468–476, 2015.

[9] D. Minoli, K. Sohraby, and B. Occhiogrosso, IoT considerations, requirements, and architectures for smart buildings—Energy optimization and next-generation building management systems, IEEE Internet Things J., vol. 4, no. 1, pp. 269–283, 2017.