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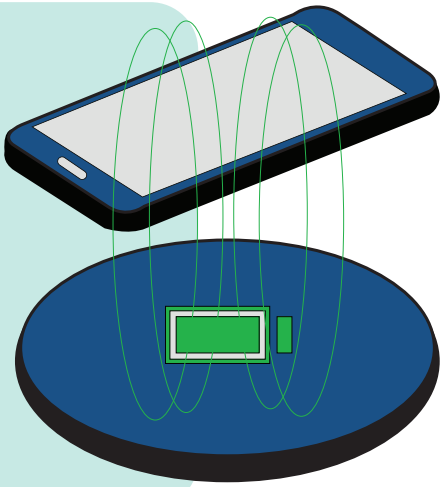
MAGNETIC FIELDS, MAGNETIC FORCES, FARADAY'S LAW

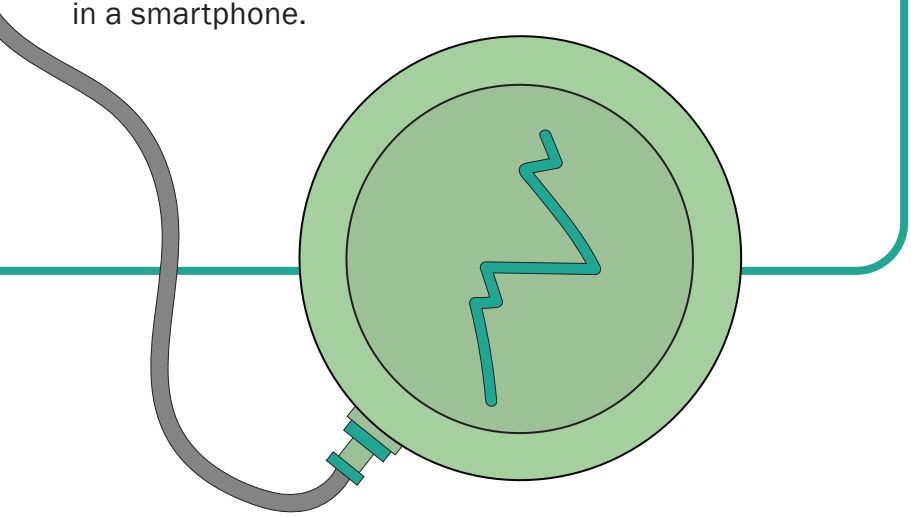
WIRELESS CHARGING

CONCEPT Wireless Charging, or Inductive Charging, is the transfer of power from a power outlet to a device without using cables. The charger often comes in the form of a puck, mat, or stand that connects to a power source. Wireless charging is most frequently used in smartphones, tablets and smartwatches.



DATA

A transmitter coil in the charging base sends out a signal. The signal searches for a receiver coil, such as one in a recent smartphone. When it senses a signal, electromagnetic induction begins. The electrons inside the transmitter coil start to flow around in the coil. This generates a magnetic field, which is sensed by the electrons in the receiver coil. The electrons trapped inside the receiver coil start to flow around the coil due to the magnetic field. This flow of electrons inside the receiver coil is the electricity powering the battery in a smartphone.

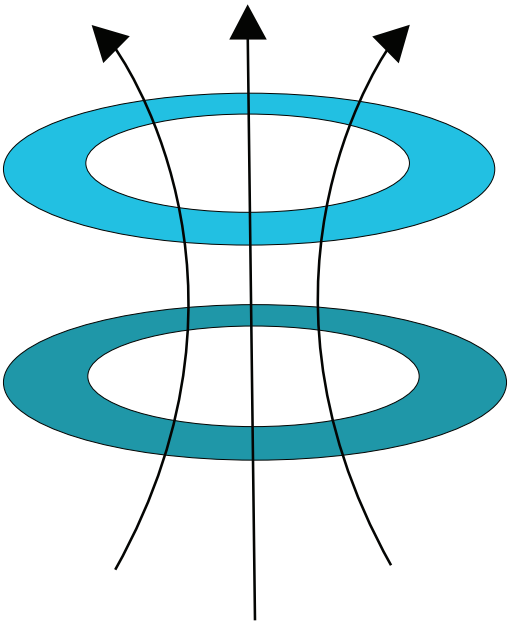


BACKGROUND

The idea that energy, power, or electricity could be transferred between points has been around since at least 1831. At the time, it was Michael Faraday demonstrating that magnetic induction can occur using an oscillating electrical current in one coil of wire sitting close to another. In 1891, Nikola Tesla invented early radio systems and the Tesla coil, which would become a core component of modern-day wireless charging units.

Wireless charging is based on inductive charging, where power is created by passing an electrical current through two coils to create an electromagnetic field. When the receiving magnetic plate on the mobile device comes into close contact with the transmitter, the magnetic field generates an electrical current within the device. This current is then converted into direct current (DC), which in turn charges the built-in battery.

Make sure it measures up



APPLICATION

Scientists and engineers are working to bring other forms of innovative wireless charging to the masses, including magnetic resonance and charging at a distance. With resonant charging, users are not required to perfectly align their smartphone onto a flat surface. Instead, they only need to keep their device in close proximity to the charging source. Other futuristic technologies offer the promise of true charging at a distance, where a power source emanates an electrical charge throughout an entire area. With true charging at a distance, simply riding on a train or walking into a restaurant could power a device in one's pocket.

TERMINOLOGY

MAGNETIC FIELD: A vector field in the vicinity of a magnet, electric current, or changing electric field in which magnetic forces are observable.

FARADAY'S LAW: Any change in the magnetic environment of a coil of wire will cause a voltage to be induced in the coil.

INDUCTIVE CHARGING: Induction is a changing magnetic field in a near piece of metal that generates electric current. Induction stoves are based on this principle: in this case, a coil in the cooktop generates a changing magnetic field through which electricity flows into the base of the pot. This causes the base of the pot to become hot. A smartphone's receiver also contains a coil, which uses the principle of induction. In smartphones, the rapidly changing current is converted into an even current with corresponding circuitry. This current then charges the smartphone battery.

REAL WORLD CONNECTIONS

Public access to inductive charging is increasingly available in airports, universities and restaurants. Soon, wireless charging could be available in every hotel room, on flights and throughout lobbies and public spaces. At home, an entire wall or desktop could become a wireless power source where devices can be arranged without any cable management needed.

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