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LOW POWER CONVERTER FOR WIRELESS CHARGING APLLICATIONS.

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Abstract

In this paper, we present the concept of transmitting power without using wires i.e .transmitting power as Magnetic waves from one place to another is in order to reduce the transmission and distribution losses. Wireless power or wireless energy transmission is the transmission of electrical energy from a power source to an electrical load without man-made conductors. Wireless transmission is useful in cases where interconnecting wires are inconvenient, hazardous, or impossible. the proportion of energy received becomes critical only if it is too low for the signal to be distinguished from the background noise.
Keywords:
Near field, Far field, Resonance, Antenna, mutual induction

1. INTRODUCTION

Wireless power transfer (**WPT**) or **wireless energy transmission** is the transmission of electrical energy from a power source to an electrical load such as electric power grid or a consuming device without the use of discrete man made conductors. Wireless power is a generic term that refers to a number of different power transmission technologies that use time varying electric, magnetic or electromagnetic fields. In wireless power transfer a wireless transmitter connected to a power source conveys the field energy across an intervening space to one or more receivers, where it is converted back to an electrical current and then utilized. Wireless transmission is useful to power electrical devices in cases where interconnecting wires are inconvenient, hazardous or are not possible.

Wireless power transmission can be non-radiative and radiative.Non-radiativetechniques power is typically transferred by magnetic fields using magnetic inductive coupling between coils of wires. Applications of this type includes electric tooth brush chargers, RFID tags, smart cards and chargers for implantable medical devices like artificial cardiac pace makers and inductive powering or charging of electric vehicles like trains or buses. wireless to charge mobile.

A current focus is to develop wireless to charge mobile and handheld computing devices such as cell phones, digital music players and portable computers without being tethered to a wall plug. Power may also be transferred by electric field using capacitive coupling between metal electrodes. An important issue associated with all wireless power system is limiting the exposure of people and other living things to potentially injurious electromagnetic fields.

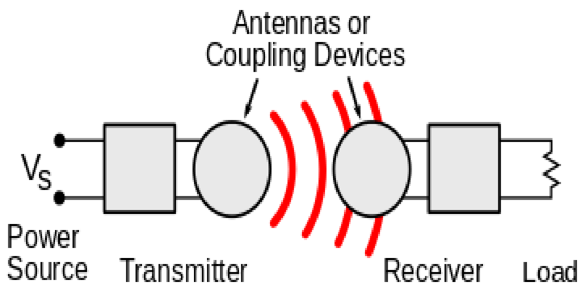

Fig 1 Generic block diagram of wireless power system.

At the transmitter the input power is converted to an oscillating electro-magnetic field by some type of antenna device. The word **antenna** is used loosely here, it may be a coil of wire which generates a magnetic field, a metal plate which generates an electric field, an antenna which radiates waves which generates light. A coupling device at the receiver converts the oscillating field to an electric current.

Instead of transmitting power via radiation, they can also be transmitted via induction coupling between the two coils. Electric and magnetic fields are created by charged particles in matter such as electrons. A stationary charge creates an electrostatic field in the space around it. A steady current of charges (direct current, DC) creates a static magnetic field around it. The above fields contain energy, but cannot carry power because they are static. However time-varying fields can carry power. Accelerating electric charges, such as are found in an alternating current (AC) of electrons in a wire, create time-varying electric and magnetic fields in the space around them. These fields can exert oscillating forces on the electrons in a receiving "antenna", causing them to move back and forth. These represent alternating current which can be used to power a load.

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The oscillating electric and magnetic fields surrounding moving electric charges in an antenna device can be divided into two regions, depending on distance **D range** from the antenna. The boundary between the regions is somewhat vaguely defined. The fields have different characteristics in these regions, and different technologies are used for transferring power:

Near-field or non-radiative region – This means the area within about 1 wavelength (λ) of the antenna. In this region the oscillating electric and magnetic fields are separate and power can be transferred via electric fields by capacitive coupling (electrostatic induction) between metal electrodes, or via magnetic fields by inductive coupling (electromagnetic induction) between coils of wire. These fields are not radiative, meaning the energy stays within a short distance of the transmitter.

Far-field or radiative region – Beyond about 1 wavelength (**λ**) of the antenna, the electric and magnetic fields are perpendicular to each other and propagate as an electromagnetic wave; examples are radio waves, microwaves, or light waves. This part of the energy is radiative, meaning it leaves the antenna whether or not there is a receiver to absorb it. The portion of energy which does not strike the receiving antenna is dissipated and lost to the system.

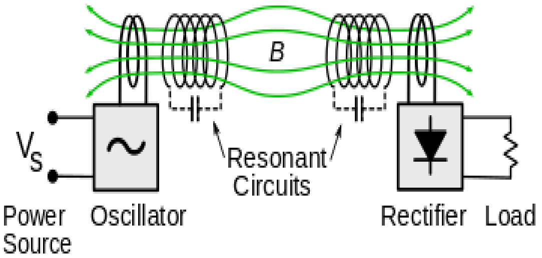


Fig 2 Resonant Inductive Coupling

Resonance, such as resonant inductive coupling, can increase the coupling between the antennas greatly, allowing efficient transmission at somewhat greater distances, although the fields still decrease exponentially. Resonant inductive coupling (electro dynamic coupling, strongly coupled magnetic resonance) is a form of inductive coupling in which power is transferred by magnetic fields (**B**, green) between two resonant circuits (tuned circuits), one in the transmitter and one in the receiver (see diagram, right).Each resonant circuit consists of a coil of wire connected to a capacitor,or a self-resonant coil or other resonator with internal capacitance.

2. LITERATURE SURVEY

Nicholatesla was the first person to develop an idea of wireless power transmission. Unfortunately, he failed because the transmitted power was diffused to all directions with 150 kHz radio waves whose wave length was 21 km .To concentrate the transmitted power and to increase transmission efficiency, we have to use higher frequency than that used by Tesla.

Microwaves: For power transmission, efficient transmission required transmitters that could generate higher-frequency microwaves, which can be focused in narrow beams towards a receiver.The development of microwave technology such as the klystron and magnetron tubes and parabolic antennas made radiative (far-field) methods practical for the first time, and the first long-distance wireless power transmission was achieved in the 1960s by William C. Brown.

Laser power Transmission: Lasers generate phase-coherent electromagnetic radiationat optical and infrared frequencies from externalenergy sources by preferentially pumping excitedstates of a “lasant" to create an inversion in the normaldistribution of energy states. Photons of specificfrequency emitted by stimulated emission enter andare amplified as standing waves in a resonant optical cavity. The most efficient DC-to-laser converters are solid-state laser diodes commercially employed in fiber optic and free-space laser communication. Alternatively, direct solar-pumping laser generation has a major advantage over conventional solid state or gas lasers, which rely on the use of electrical energy to generate laser oscillation since the generation of electricityin space implies automatically a system level efficiency loss of roughly 60%. To generate a laserbeam by direct solar pumping, solar energy needs to be concentrated before being injected into the lasermedium.

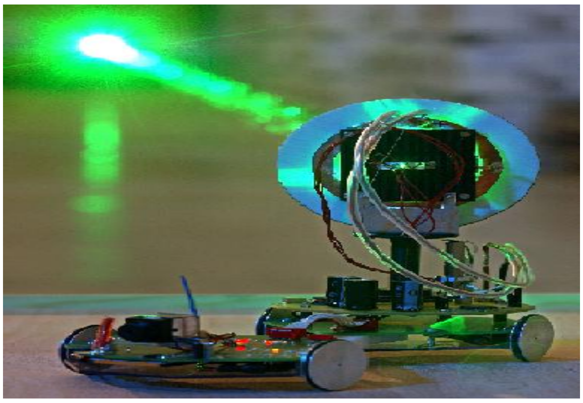


Fig3 fully laser powered autonomous rover.

3. METHODOLOGY

The main objective of this project is to develop a device for wireless power transfer. The concept ofwireless power transfer.Based on this concept, the project is developed to transfer power within a small range. WPT is convenient for the user because it is accessible and gives the users more versatility with their electronic devices. This project can be used for charging batteries those are physically not possible to be connected electrically such as pace makers (An electronic device that works in place of a defective heart valve) implanted in the body that runs on a battery. The patient is required to be operated every year to replace the battery. This project is designed to charge a rechargeable battery wirelessly for the purpose. Since charging of the battery is not possible to be demonstrated, we are providing a DC fan that runs through wireless power.

This project is built upon using an electronic circuit which converts AC 230V 50Hz to AC 12V, High frequency. The output is fed to a tuned coil forming as primary of an air core transformer. The secondary coil develops a voltage of HF 12volt. Thus the transfer of power is done by the primary (transmitter) to the secondary that is separated with a considerable distance (say 3cm). Therefore the transfer could be seen as the primary transmits and the secondary receives the power to run load.

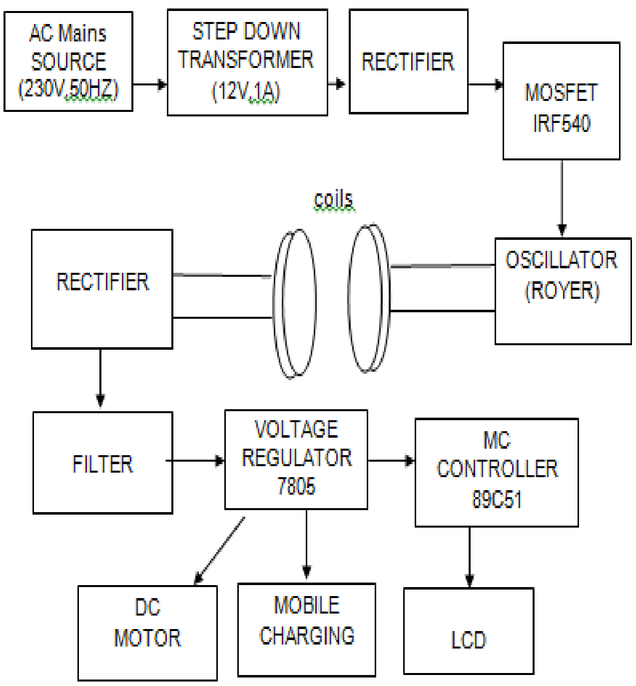
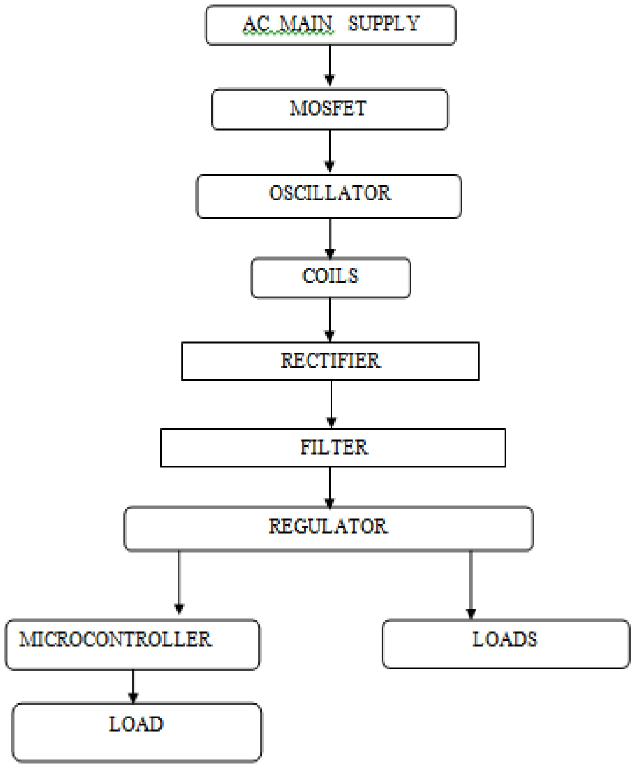


Fig 4. Block diagram

4. ALGORITHM



Magnetic Coils:

Transmitter coils

For this Wireless power transmission mobile charger circuit using inductive coupling project, we can use 6mm enamelled wire (Magnet wire) for constructing the transmitter coils. Actually this enamelled wire is a copper wire, which has a thin layer of insulation coatings on it. Here the transmitter coil is constructed with a diameter of 16.5cm or 6.5 inches and 8.5 cm of length.

The equation for finding the inductance of a single layer air core coil is given below.

$L = 0.001\ N2\ (a/2)2 / (114a + 254l)$ H

Now we are applying the desired values for the coil,

$L = 0.001\times22\times(0.165/2)2 / ((114\times0.165) + (254\times0.085))$ H

$L = 0.674\ \mu$ H

Receiver Coil

The receiver coil in the wireless power receiver section is constructed using 18 AWG copper wire having diameter of 8cm.The equation for finding the inductance of a single layer air core coil is given below.

$L = 0.001\ N2\ (a/2)2 / (114a + 254l)$ H

Now we are applying the desired values for the coil,

$L = 0.001\times32\times(0.08/2)2 / ((114\times0.08) + (254\times0.01))$ H

$L = 1.235\mu$H

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5. RESULT AND DISCUSSION

5.1 ADVANTAGES

-Never run out of battery power in wireless zones

-Power transfers more efficiently than through wires

-No more changing batteries

-No messy cords

-The power can be delivered in any directioni.e ,**omnidirection**

-Reduces the use of disposable batteries

-Reduces energy loss

-These rays are not harmful to humans

.5.2 DISADVANTAG

-Low efficiency compared to the wired charging method.

-Extra heating

-The wireless mobile charging circuit is more complicated than the traditional charger.

-The cost is comparatively higher than the wired charger.

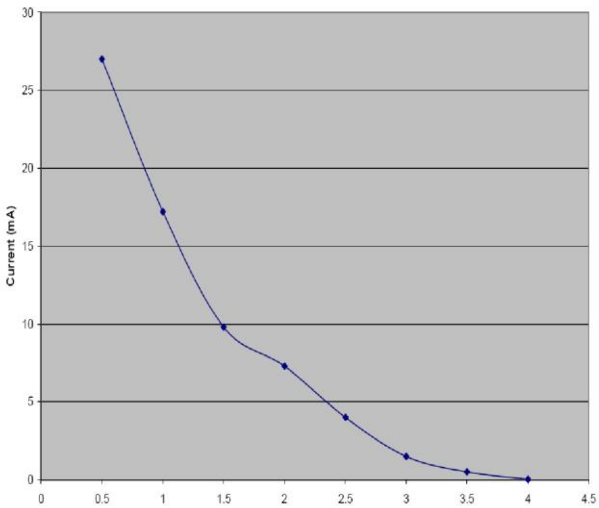

Fig: 5.1Distance v/s current graph

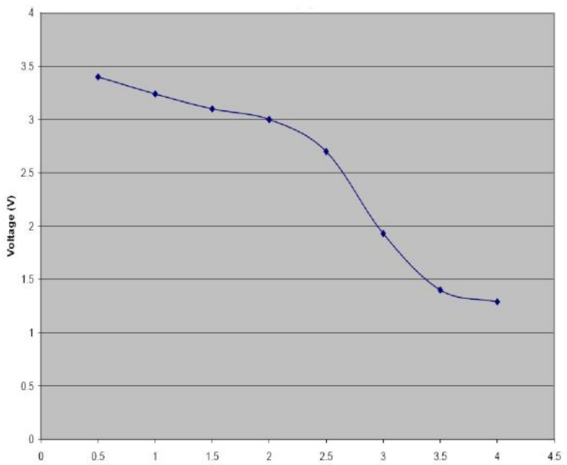

Fig:5.2 Voltage versus distance chart

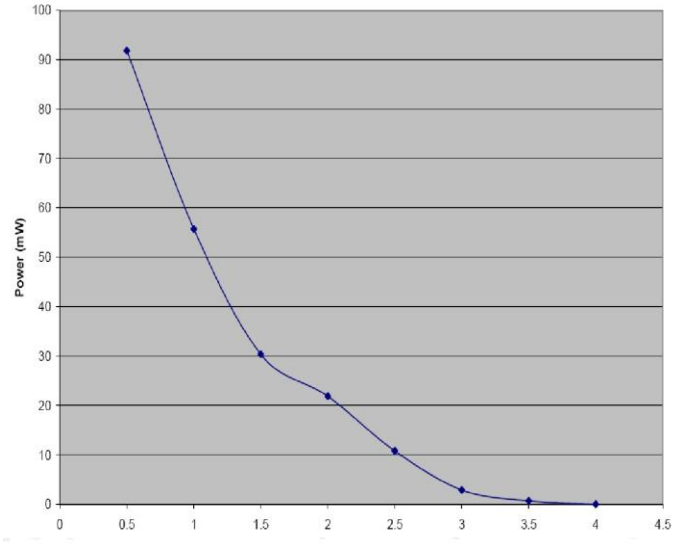

Fig :5.3 Power Vs. Distance Chart

6. CONCLUSION AND FUTURE SCOPE

Presenting magnetic and electric models for a capacitor compensated wireless power transfer system, the transfer power, the efficiency and the coupling coefficient are analyzed for a high power application. It is observed that the transferred power and efficiency versus the resonance frequency follow different trends. In fact, these two requirements couldn't be achieved at the same frequency at the first glance. In other hand, the high transferred power is obtained at a low resonance frequency but the high efficiency is achieved at a high resonance frequency. The crucial advantage of using the non-radiative field lies in the fact that most of the power not picked up by the receiving coil remains bound to the vicinity of the sending unit, instead of being radiated into the environment and lost. With such a design, power transfer for mobile -sized coils are more than sufficient to run a mobile can be transferred over room-sized distances nearly omni-directionally and efficiently, irrespective of the geometry of the surrounding space, even when environmental objects completely obstruct the line-of-sight between the two coils. As long as the mobile is in a room equipped with a source of such wireless power, it would charge automatically, without having to be plugged in. In fact, it would not even need a battery to operate inside of such a room." In the long run, this could reduce our society's dependence on batteries, which are currently heavy and expensive. At the same time for the long range power transmission, power can be sent from source to receivers instantaneously without wires, reducing the cost.

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