WIRELESS POWER TRANSFER
PROJECT 072

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OBJECTIVES

MAIN OBJECTIVE
Develop a device for wireless power transfer, based on this concept the project should aim to develop a device that transfers power within a small range.

SPECIFIC OBJECTIVES
Å Design and assemble a power supply unit.
Å Step up the dc supply.
Å Design and assemble an appropriate oscillator.
Å Develop transmitter and receiver coils.
Å Design the receiver module and rectify the ac voltage received on the receiver coil.
Å Designing a battery charging circuit.
Introduction

History of Wireless Power Transfer
Main concepts of wireless transmission of electric energy
Health and safety considerations guided by IEEE and ICNIRP
WPT Standards and Alliances e.g Qi by the Wireless Power Consortium (WPC), Rezence by the Alliance for Wireless Power (A4WP), Power Matters Alliance (PMA)
Inductive Coupling

Method used was Inductive coupling

Basic theory on how it was applied in the project
Principle of Operation
Design of Transmitter

Power Supply
DC boost converter
Oscillator
Design of Receiver

Rectification circuit
Battery charging circuit
Software used in the battery charger
Results and Analysis

Distance of separation
Gauge of the coil
Effect of placing hurdles between the Tx coil and Rx coil
Misalignment of coils
Results and Analysis

Oscillator
- Heating up of the power MOSFETs
- Failure of oscillator to oscillate

Battery Charging circuit
- Loading of rectifier voltage
- Energy consumption by the relay and buzzer
Conclusion

Based on the theory of wireless charging via inductive coupling, which was the method used in the project, it was seen that various aspects i.e. distance, resonant frequency, quality factor; coil turns ratio determine the efficiency of WPT. In addition there is an exponential decay for power versus the distance of separation.

From the analysis it was seen that at 0cm separation distance, the power transfer was most efficient as seen by the brightness of the test lamps.

From the project WPT for short range or near field occurred up to a distance of 5cm after which the power transferred began to significantly drop.

It can also be concluded that WPT can be used in other applications. In the project we were able to charge a 9V battery from power that was transmitted wirelessly.

Lastly, we can conclude that WPT is not affected by non-magnetic materials shielding the two coils. This therefore means that it can be effectively used in the medical field to charge pacemakers and other devices.
Recommendation for future work

**Research on the variation of the Q factor and damping factor** this can be done by designing a receiver circuit which is in synchrony with the transmitter circuit. The receiver circuit could have a feedback system which will change the load accordingly and which can be detected by the oscillator so that it also adjusts accordingly to achieve optimum power output.

**Studying on the effect of using multiple receivers on the power output**, a major challenge in the design was obtaining a reasonable amount of power. This study can investigate if the power obtained in the receiver will be higher.

**Using an array of transmitter and receiver antennas and coils** so as to establish which is more efficient.

**Oscillator load pull needs to be studied** In this project the oscillator was designed without much consideration of frequency pushing and the current design does not take into account optimum power operating point for the oscillator. A study needs to be conducted to establish these parameters.

**Research on a better, efficient circuit** the use of phased locked loops (PLL) and power amplifier needs to be studied in order to achieve better frequency stability, more power and efficiency.
THANK YOU