Wireless Transmission of Electricity

Bachelor’s Thesis

Kunal Dhodapkar

kunaldesign.com

HOW IT ALL STARTED

I desire to work on technologies that would change the world.

In 2016, I read a **fascinating research** by MIT where they tried to transmit electricity wirelessly over long distances.

I saw a **great possibility** in this and decided to explore this concept of in my Bachelor's final project work.

I worked under the guidance of **Dr.Ramachandra Reddy** (DEAN, School of Electronics) and his constant support and encouragement was invaluable in achieving success in this project.

INTRODUCTION

Transformers, inductive mobile chargers all use the concept of magnetic coupling to exchange energy between coils. But their range and efficiency is less due to the fact that much of energy is not transmitted due to ineffiective linking.

This loss can be greatly prevented if both the coils resonate at a common frequency. The principle says,

Coupling between two coils is maximum at a particular frequency called resonance frequency, which depends on the geometric dimensions of the coils.

SCOPE

I decided to explore the concept of magnetic resonance coupling in **2** phases:

Phase 1:

Software simulations to model the prototype in two popular system configurations,

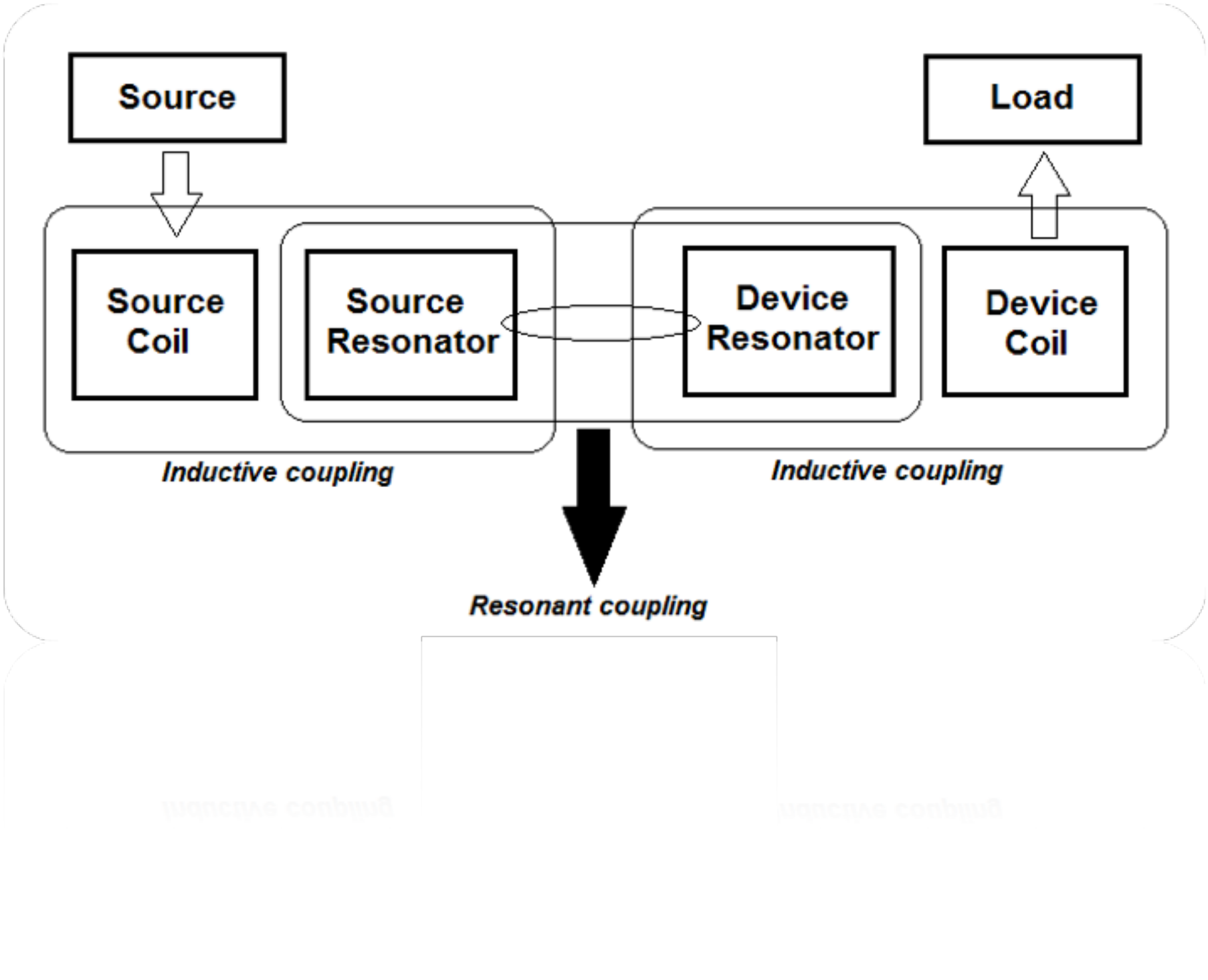
- Two Coil System (TCS Model)
- Four Coil System (FCS Model)

Phase 2:

Hardware experiment to validate the software findings.

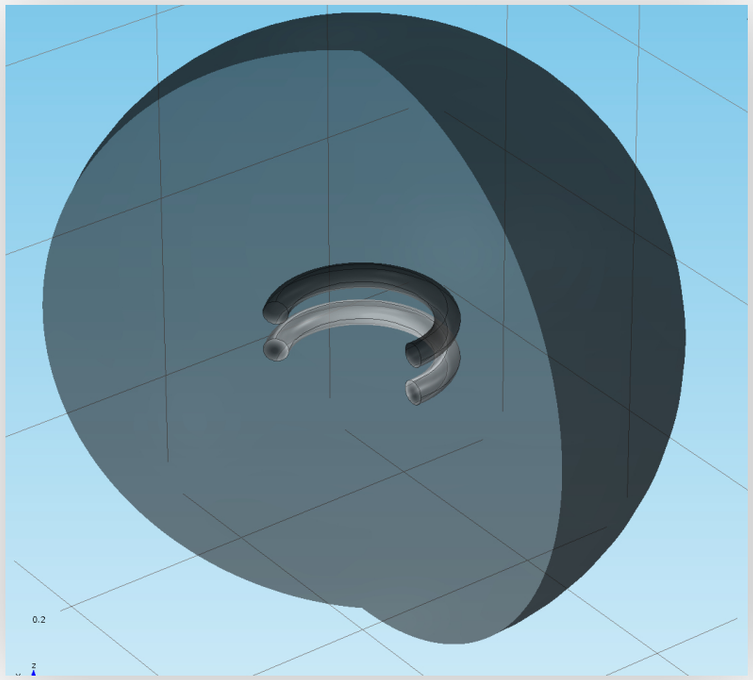
PROJECT WORK

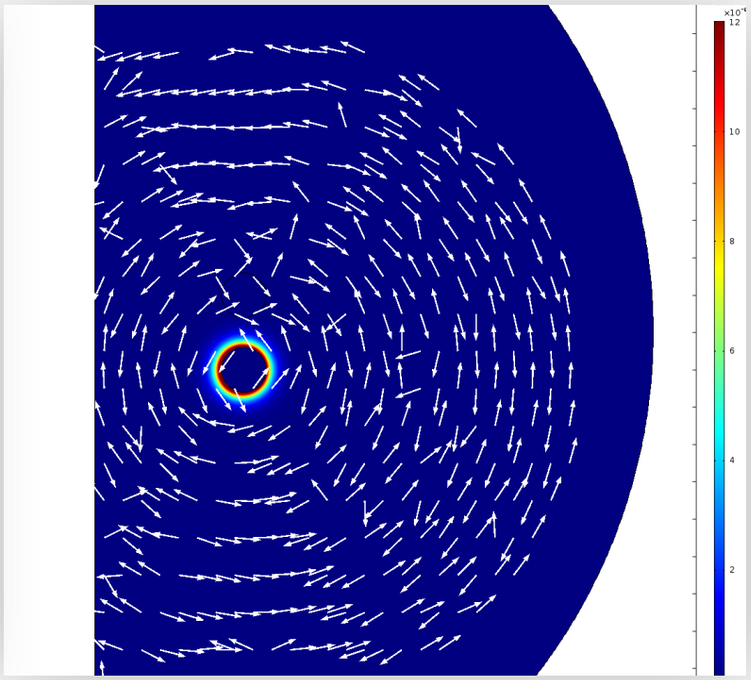
SYSTEM MODEL

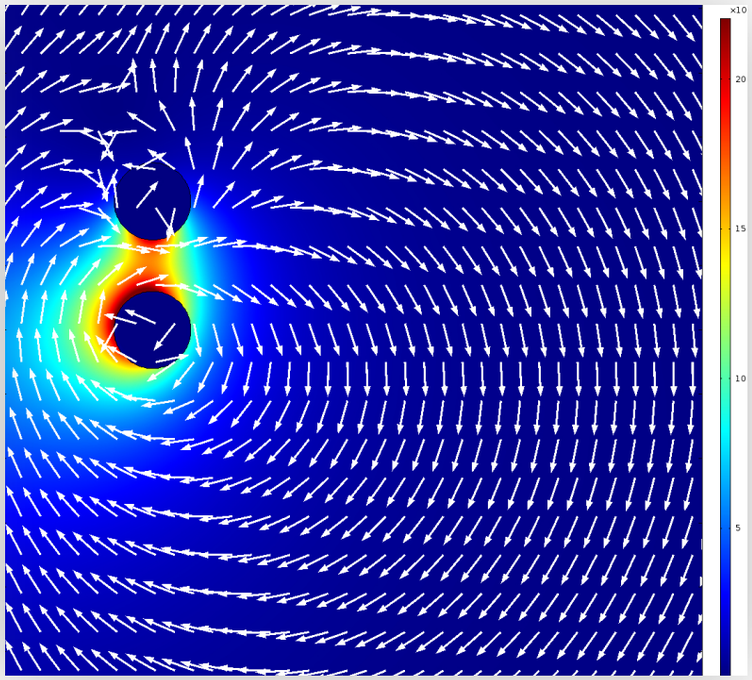


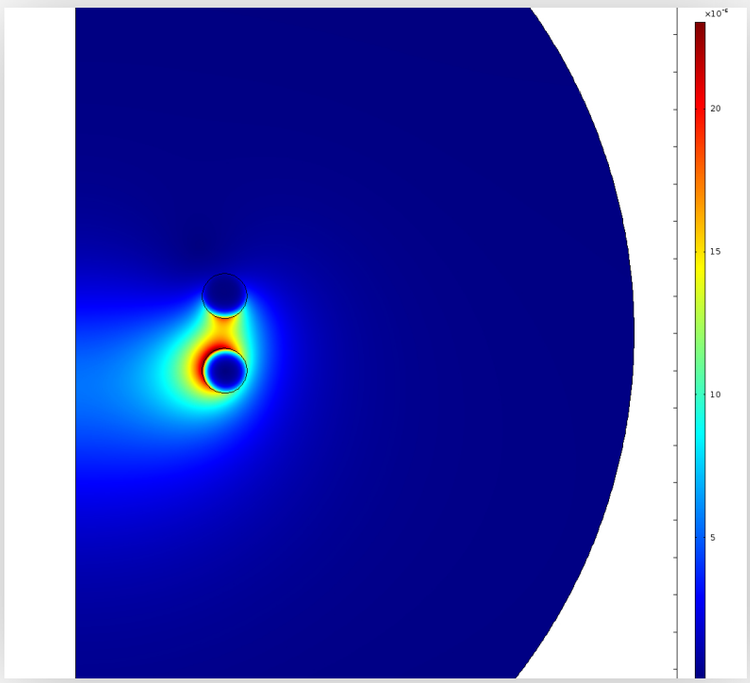
SOFTWARE SIMULATIONS

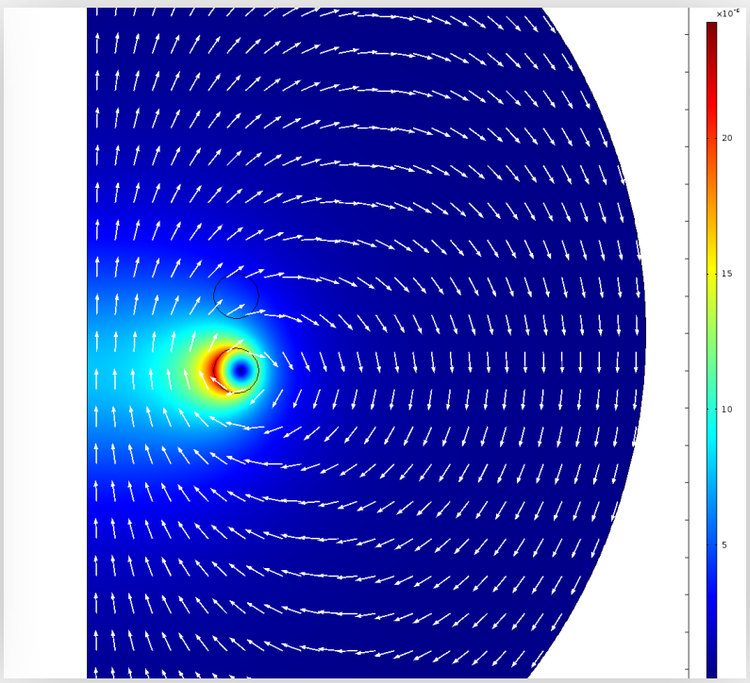
Behaviour of two coils at various frequencies

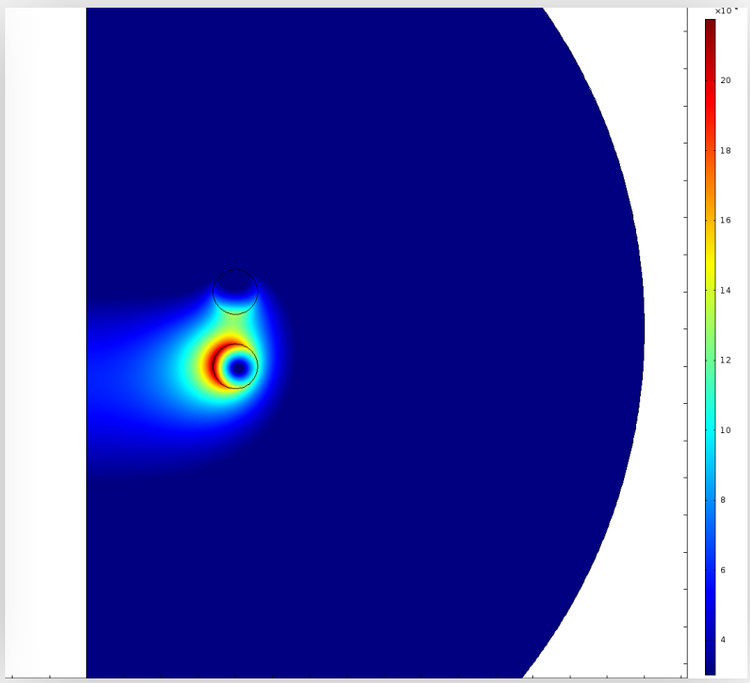








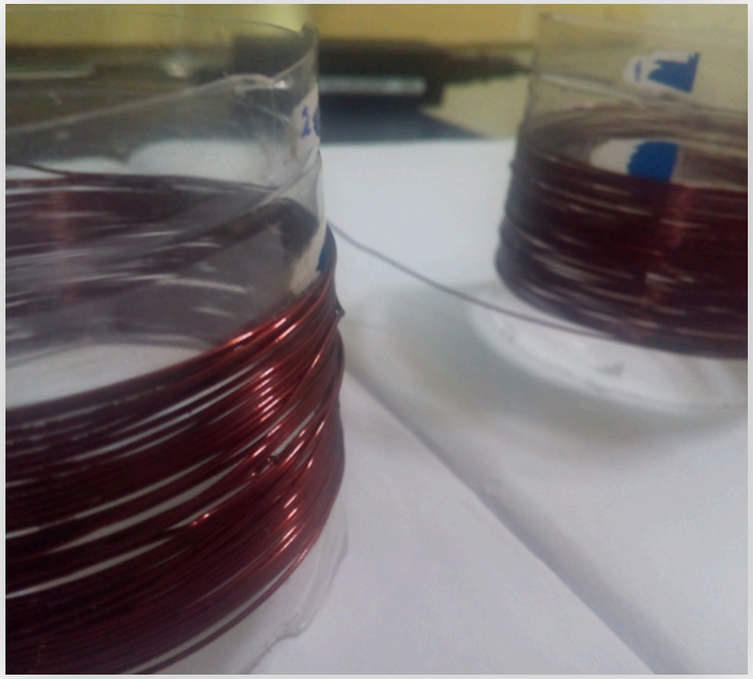


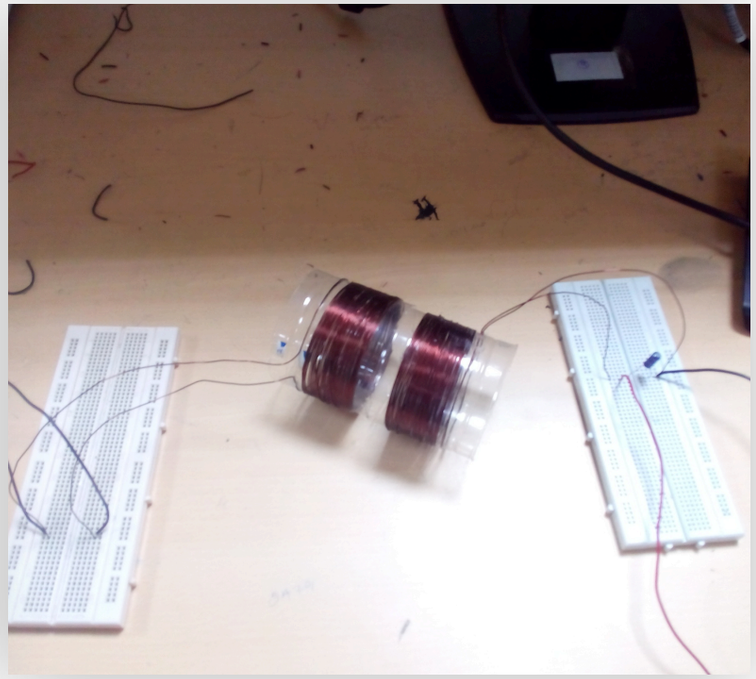


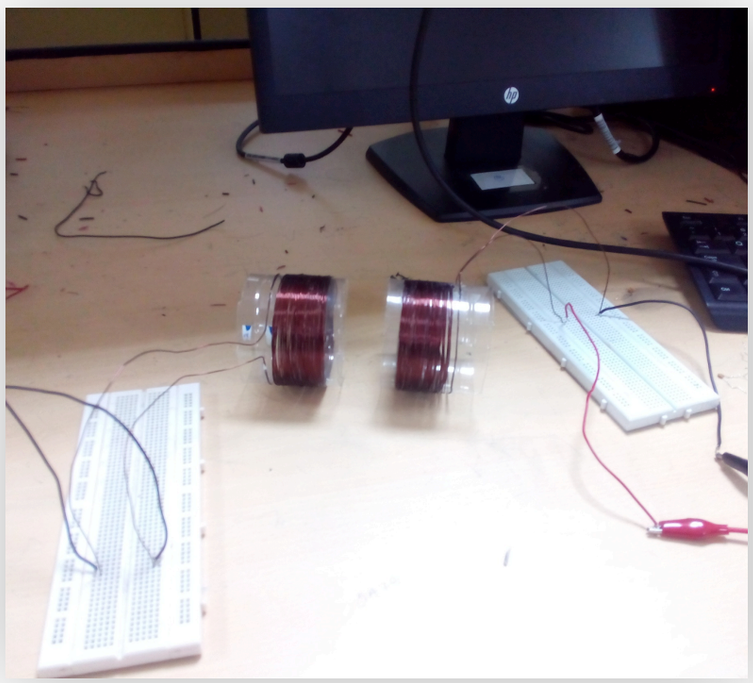
Simulations created using COMSOL Multiphysics

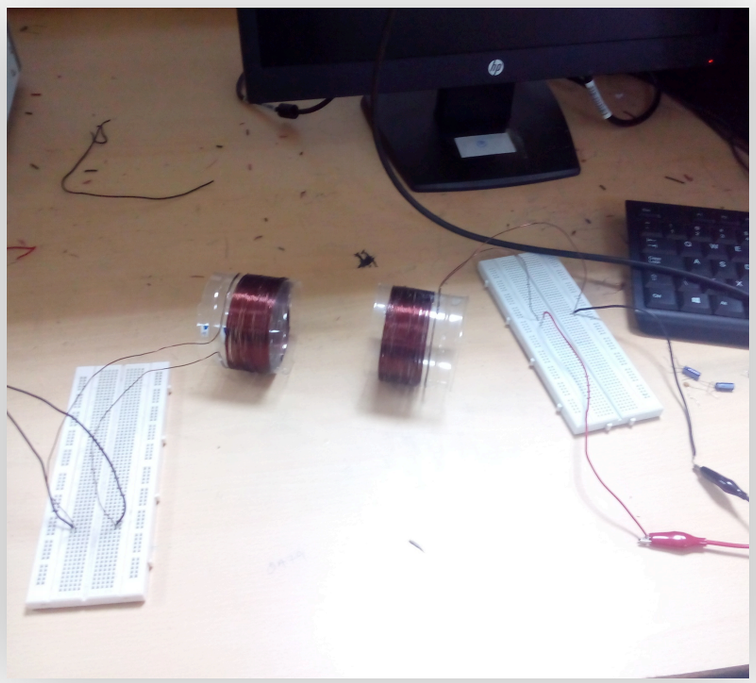
HARDWARE VALIDATION

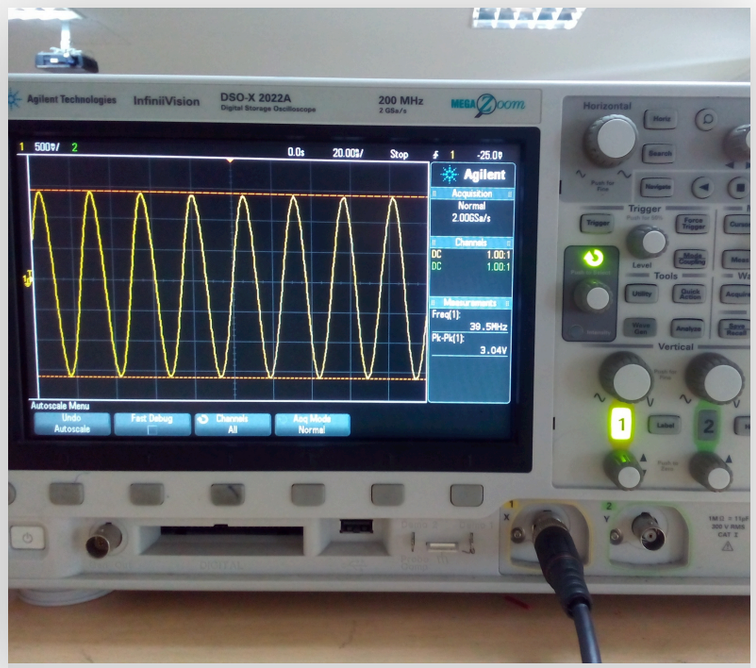
Two coil and four coil systems











Experiments carried out in University Lab

RESULT

In hardware experiments FCS Model was found performing significantly better and giving extremely high efficiency than TCS Model, which is traditionally used in transformers and low performance inductive chargers.

With magnetic resonance, wireless charging distance was increased by **5x** with a transfer efficiency of **98%.**