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# WIRELESS POWER TRANSMISSION SYSTEMS BASIC PROTOTYPE DESIGNING: A STUDY BASED ON POWER LOSSES, EFFICENCY & ADVANTAGES

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## ABSTRACT

Wireless power transmission system is alternate transmission systems without the conventional transmission line to carry short ranged transmission systems electricity. There are many techniques to fabricate to a wireless system prototype design. It is hard to choose which technique is feasible whilst keeping power losses, efficiency, cost & feasibility. This paper fills the gap by presenting experimental results of a wireless power transmission system that will help in better understanding and proper implementation of wireless power transmission systems.

**KEYWORDS:** Wireless Power Transmission System, WPTS, Efficiency, Power Losses, Cost, Quality

## INTRODUCTION

The concept of wireless transmission system was used as in some environments and cases wireless transmission system is more feasible than transmission lines system. Due to Power crisis in Pakistan it may be used as an alternate system in homes. Since Power consumption is increasing globally we can't rely on single method of electricity transmission. Wireless transmission system can be used in homes as mostly devices operate up to a voltage of 20 volts. Our Prototype will be designed on the basis of coil coupling using the principle of mutual induction which will be explained in latter section. This research is intended to find the values of different parameters and compare the overall performance of this system. Also the research aims to evaluate common parameters of Wireless Power Transmission System (WPTS). Parameters used in research to evaluate our system are given below.

- Efficiency
- Input/output Values
- Advantages

The next section will highlight related work from other researchers in the field of Wireless Power Transmission System.

## LITERATURE REVIEW

In this section researches related to WPTS and the concept of WPTS are not used. Extensive research in Wireless Transmission system has given rise to energy harvesting techniques. Nikola Tesla was the pioneer and founder in the field of wireless transmission of electrical. Maxwell's electromagnetic theory was the basis of wireless transmission break

through followed by Hertz transmission of radio waves in the 19th century. Hidetsugu Yagi (Yagi.1926) a Japanese engineer was the first one to unsuccessfully design a wireless system prototype however he managed to research on short generation of wave length waves.

Wei Xin Lei, He Zhang (Zhang 2012) in their research have summarized the different parameters to better understand the concept of wireless transmission system moreover gave the idea of magnetically coupled, low efficiency. The result of expression of parameters relationship was derived between current, efficiency and distance. In short the results of from paper show that our theoretical derivation is correct.

According to Andrea Goldsmith of Stanford University wireless channel is unpredictable, highly unstable and a difficult medium for highly efficient power transmission. The total Power fades as the distance is increased between transmitter and receiver which are due to multipath fading which states that the received power and signal density at receiver may vary completely when compared to the transmitted signal by the transmitter. According to basic path loss equation also known as Friis transmission equation path Loss can be given by:

$$L=20\log 10\ \frac{4\pi d}{\lambda}$$

The above equation for calculation of path loss is usually taken as an approximation or predication of our values and depends upon λ wavelength and distance between receiver and transmitter. Different models can be used to understand the concept of high power losses in wireless transmission. The path losses are different depending upon the frequency band ranges. Also the capacity of wireless transmission channel in case of short band frequencies is limited.

## PROBLEM STATEMENT

The research is intended to answer the following research question:

- Overall Results of our design prototype based upon discussed parameters.
- Limitations vs Improvements (creating a stable transmission system)

## RESEARCH METHODOLOGY

We used a practical approach designed a basic prototype using principle of mutual induction and coupling and performed an experiment to see the result see different values of different parameters that we already have defined. We will use different software's to simulate our prototype first before implementing it first. Flow chart of our project is shown below.

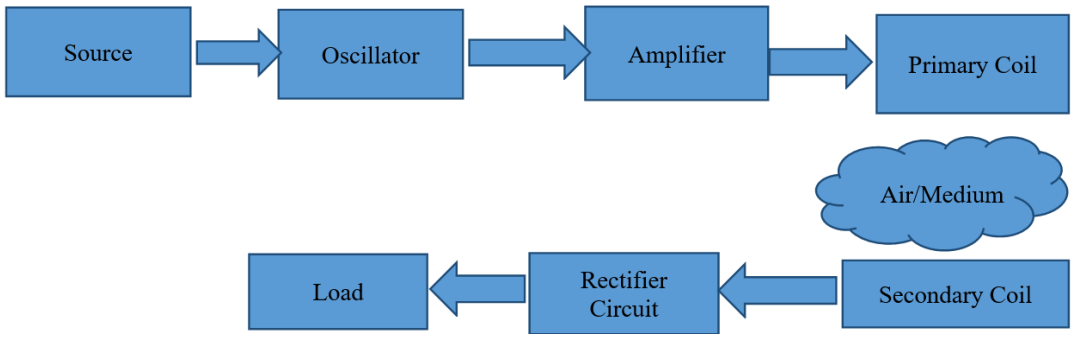


**Figure 1: Flow Chart of our Experiment**

Our Project Circuit is divided into following parts with specifications:

- Oscillator (Colpitts 200KHZ-2MHZ)
- Amplifier (non-inverting)
- Primary & Secondary Coils (Copper/variable turns, 400: 100,150:50)
- Voltage Multiplying Rectifier
- Load (charging device cell phone etc.)

## RESULTS AND ANALYSIS

As mentioned above, an experiment was conducted to answer both the research questions

- Overall results of design prototype based upon parameters.

Based upon our prototype we got following results from our experiment we get following results explained in table below.

**Table 1: Result Table of our Experiment**

| | |
|---|---|
| Input Power | 6 Watt |
| Input Current | 2.1 Ampere |
| Input Voltage | 12 V |
| Output Voltage | 6 V |
| Output Current | 120 mA |
| Output Power | 2.1-2.7 Watt |
| Efficiency | 30-35% |
| Transmitted Distance | 5-6 cm |

If we compare wireless system with other modes of transmission, we see that wireless transmission system can be used in many fields

- Limitations vs Improvements (creating a stable transmission system).

Mostly wireless Power Transmission has a very limited use as it cannot be used at industrial level to operate very high voltage machinery so it can be safely deduced that wireless power transmission system is feasible for domestic use only. Moreover, it is impossible to sustain a constant power level. Since frequency waves scatter power losses are high and mostly energy is unused. Since Waves can be received from anywhere around the globe so the overall system can never be idle. In order to improve the efficiency and improve power losses WPTS can be designed using multiple antenna arrays. Massive solar panels can be used to harvest sunlight and then transmit electricity wirelessly using this system.

## CONCLUSIONS

Designing a wireless transmission system is a very tricky task and to make it efficient and accurate or precise (in terms of minimizing power losses & achieving maximum efficiency) is even a bigger challenge. Many engineers failed to make an accurate wireless transmission system due to lack of practical knowledge. Practical Implementation of different circuits and maintaining accurate values over a long period of time was a real difficult problem. Although their simulations show perfect results but practically other factors influence our output. To make them accurately is our real

accomplishment. Moreover, it is observed that a significant change in distance means redesigning the coils and circuitry of the whole WPTS. Due to expensive resources a perfect WPTS would be highly expensive and uneconomical. By the implementation of this logic one can build and implement any kind of WPTS with low or medium voltage range if we have proper resources and designing. However, this system cannot be implemented industrially (at very high voltage levels) as it has a lot of health hazards and power losses will be very high moreover it's not economical. Indeed, we have learned a lot of things during this project.

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