Faculty of Electrical and Electronic Engineering Technology

DEVELOPMENT OF A MICRO SCALE TESLA COIL FOR WIRELESS POWER TRANSFER

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Bachelor of Electrical Engineering Technology with Honours

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A project report submitted
in partial fulfillment of the requirements for the degree of
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Sesi Pengajian: 1-2021/2022

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Date : 31/12/2021

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I hereby declare that I have checked this project report and in my opinion, this project report is adequate in terms of scope and quality for the award of the degree of Bachelor of Electrical Engineering Technology with Honours.

Signature : 

Supervisor Name : DR AZHAN BIN AB RAHMAN

Date : 31/12/2021

Signature :

Co-Supervisor :

Name (if any)

Date :

DEDICATION

I dedicate this Bachelor Project for my parents and my siblings who do not stop praying for my success.

Not to be missed is my project supervisor, Dr. Azhan Bin Ab Rahman who always gave advice and reprimands in me to complete this project.

ABSTRACT

Tesla Coil, a kind of thunderous air center transformer, used to produce high voltage and low flow power. Even though the Tesla Coil is an old creation, there are helpful for creating numerous gadgets today. Tesla Coil used to lead inventive investigations in electrical lighting, fluorescence, x-beams, remote energy move for electrical force transmission and furthermore for instructive purposes. Tesla curl plans utilized high voltage rotating current force source, high voltage capacitor, and a sparkle hole to energize the essential side of the Tesla coil framework with occasional eruptions of high recurrence current. The primary and secondary coil is planned to reverberate at a similar recurrence. The principal motivation behind this task is to plan a small-scale size of tesla coil that utilization a low dc (direct current) voltage as an essential circuit contribution rather than ac (exchanging current) voltage and will create an air conditioner high voltage at optional circuit side. This undertaking will demonstrate that even though the information is just a low DC voltage, this small Tesla Coil can venture up the information voltage and all the while create a high voltage roughly 2kV at the optional side. The size of Tesla Coil is additionally one of the primary issues, which average Tesla Coil for the most part have an enormous size of its development. Accordingly, a small-scale Tesla Coil will be use as a drive generator with low voltage rating. Also, this venture enjoys contributed numerous benefits instead of ordinary Tesla Coil which is massive and has numerous portability issues.

ABSTRAK

Tesla Coil, sejenis transformer pusat udara yang gemuruh, digunakan untuk menghasilkan voltan tinggi dan kuasa aliran rendah. Walaupun Tesla Coil adalah ciptaan lama, ada gunanya membuat banyak alat hari ini. Tesla Coil digunakan untuk memimpin penyelidikan inventif dalam pencahayaan elektrik, pendarfluor, sinar-x, pergerakan tenaga jarak jauh untuk penghantaran daya elektrik dan seterusnya untuk tujuan instruktif. Pelan Tesla curl menggunakan sumber daya arus berputar voltan tinggi, kapasitor voltan tinggi, dan lubang berkilau untuk memberi tenaga pada bahagian penting kerangka gegelung Tesla dengan letusan arus berulang tinggi sekali-sekala. Gegelung primer dan sekunder dirancang untuk bergema pada kambuhan yang serupa. Motivasi utama di sebalik tugas ini adalah untuk merancang gegelung tesla berskala kecil yang menggunakan voltan dc (arus terus) rendah sebagai sumbangan litar penting daripada voltan ac (pertukaran arus) dan akan mewujudkan voltan tinggi penghawa dingin pada pilihan sisi litar. Perjanjian ini akan menunjukkan bahawa walaupun maklumatnya hanya voltan DC rendah, Tesla Coil kecil ini dapat menjana voltan maklumat dan pada masa yang sama menghasilkan voltan tinggi kira-kira 2kV di bahagian pilihan. Ukuran Tesla Coil juga merupakan salah satu masalah utama, yang mana rata-rata Tesla Coil mempunyai ukuran pengembangannya yang sangat besar. Oleh itu, Tesla Coil berskala kecil akan digunakan sebagai pemacu pemacu dengan nilai voltan rendah. Juga, usaha ini menikmati banyak faedah dan bukannya Tesla Coil biasa yang besar dan mempunyai banyak masalah mudah alih .

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v	-	Voltage

LIST OF ABBREVIATIONS

V	-	Voltage
N	-	Number of Turns

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CHAPTER 1

INTRODUCTION

1.1 Background

Power and energy are a form which can be interpreted as a form of cause that can move something no matter in any shape and mass. Power can also undergo a process of transfer where it occurs between one point to another. The era of rapid modernization has reached its highest level as power transfer technology is actively developing over time. Earlier, power and electrical energy performed the transfer process using a cable medium. If we can observe, the conventional method of transferring power through cables is currently carried out through the method of planting cables through underground. The method has been practiced for a long time and until today, the conventional technology is still practiced and practiced in our country, Malaysia. However, a new technology, namely wireless power transfer technology has begun to be brought into the industry at this time and it is still in the phase where it is still in the process of research and development (R & D).

This wireless power transfer technology is believed to be able to breathe new life into the industry related to the existence of indirectly will further promote wireless methods comprehensively in the present era. Wireless technology is seen as an alternative in simplifying, especially in the context of power transfer, it can further reduce the existing conventional methods where wireless technology is a simplifying technology. Figure 1.0 is provided with an overview of the Tesla Coil project. Where Tesla Coil is one of the wireless power transfer methods that have been created by Nikola Tesla.

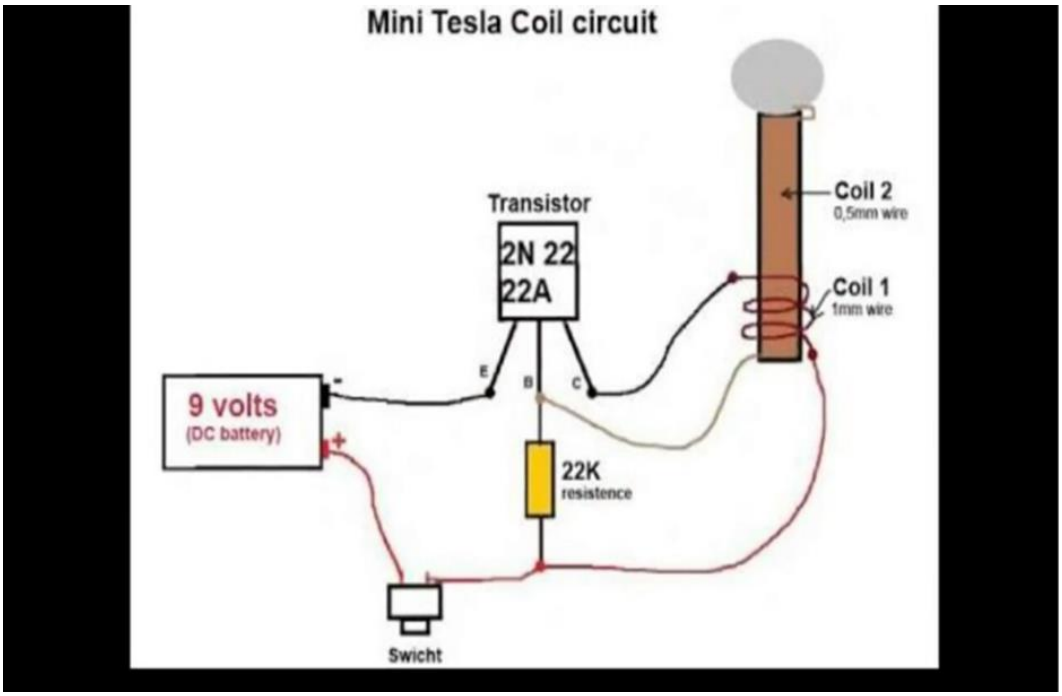

Figure 1.0: Example of Simple Tesla Coil

Figure 1.1 provides a diagram that illustrates the scope of this project or study. It also shows the way how the Tesla coil will work in real situation. The Tesla coil depend on size that have been created. In Figure 1.1 also will show to us on how the way people will use to see the function of the Tesla coil.

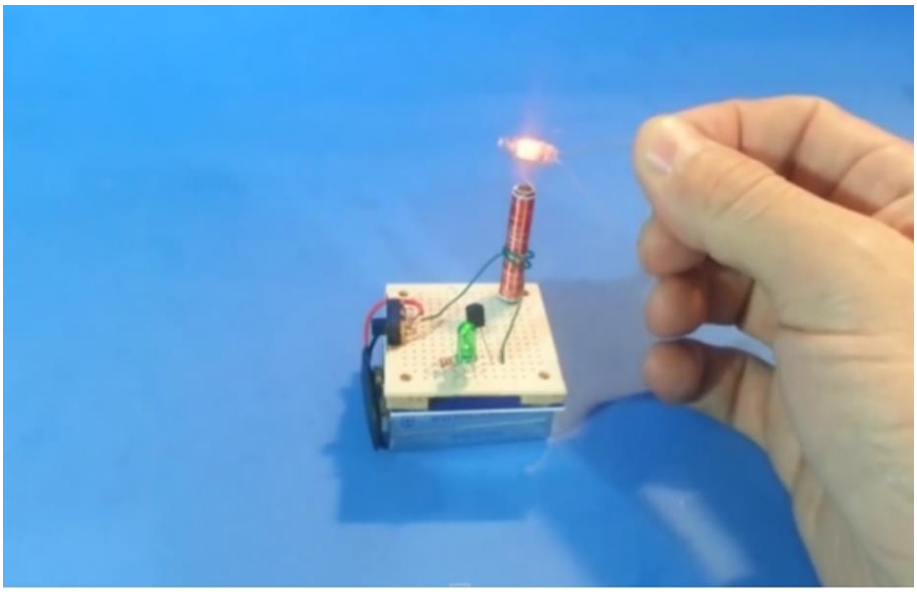

Figure 1.1: Tesla Coil mini or small scale

1.2 Problem Statement

Conventional wired or cable power transfer technology is not seen to cause any problems or difficulties, but if studied in more depth and do various feedback sessions there is a lot or no negative feedback on conventional power transfer methods at this time. But if we talk about some wireless technologies for the purpose of power transfer that are already in the current market, there are also some flaws that are seen and carefully evaluated. Among the problems that have arisen and have been taken into consideration are disturbing the environment and causing disturbance to the residents because of cable planting activities, the size of the current wireless power transfer devices is only for use for large quantities of power. However, in terms of the list of problems that arise is made and listed is from the current situation and is expected if the feedback taken is 5 years or 10 years to come, various other problems and difficulties that will arise as a result and impact of the use of power transfer technology in conventional ways.

1.3 Project Objective

- Develop Tesla Coil on a small or mini scale.
- Produces a Tesla Coil capable of delivering power on a small scale.
- To observe the output from the effect of the varies value of input voltage from the primary coil.

1.4 Scope of Project

- Produces maximum power up to 9V.
- The distance of the presence of the load does not exceed 1 meter.
- Only for low power load use.

1.5 Thesis Organization

Thesis Organization basically is a flow of the project and for the report to be done. It is consisting of 5 Chapter where's starting with Chapter 1: Introduction, where in this chapter it will talks about the surface of the project such as like background study, problem statement, objective, and the scope of study. Then it will continue with Chapter 2: Literature Review. In literature review, it will show on the as much as references have been take. It is like doing a comparison and gain data to make on our project. After that, continue Chapter 3: Methodology. In methodology, it will talk about the method exactly on how the project will be done such as the flowchart, and the Gantt chart. Next continue with Chapter 4: Results. In this chapter it will state on the results of the project such as simulation results and the hardware results. Lastly, Chapter 5: Conclusion and Further Recommendation. This chapter will be the closing of the project and this part there will be the conclusion based on the project and will have the further recommendation of this project if there's individual actin who want to continue this project.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Literature review is a section in a study or thesis where it is an important part. In the literature review, there is content that includes all the basic information related to the research or thesis, the technical part, the reference part of the previous study and the part about the materials used in implementing the project on this study or thesis. There are also summaries from the results of references and studies based on several theses that have been implemented by previous parties where the results of the reference findings will be used as a benchmark to implement the latest projects and thesis.

2.2 Tesla Coil

Tesla Coil is a technology or invention that is about 130 years old. It was designed by an inventor, Nikola Tesla. Nikola Tesla was born and raised in the Austrian Empire. Tesla Coil is a gadget which is an electrical full transformer circuit what capacities and fills in as a medium to create high voltage, low flow, high recurrence rotating flow power. In short, Tesla Coil is a device or device that can transfer energy, electrical wave power by wireless or in other words it does not use any cables or wires for the work process of transferring power, electrical energy. Energy waves will hover around the Tesla Coil transmitter and if there is any electrical device or load placed near the transmitter, the device will receive the input of energy supply, electrical power into the device or load. However, the functionality of the device depends on the amount of energy, the power emitted by the Tesla Coil and if a device or load is a device that requires a large amount of energy, power, then the Tesla Coil must produce a large amount of energy. The tesla coil is an air looped transformer which gives high recurrence current and voltage yield. (Manchanda, 2016)

2.2.1 Tesla Coil Revolution

Tesla developed a device that stretched the boundaries of electrical agreement to explore high-recurrence and high-voltage. The tesla coil is essentially full transformer which is utilized to created possibilities in the scope of tens to hundreds, or even large number of kilovolts (Farriz et al., 2010). None of the circuit's commonplace segments were obscure at that point, yet its plan and activity together accomplished exceptional outcomes, considering Tesla is extremely breath taking in development of most especially of an uncommon transformer or loop which is generally the core of the circuit's exhibition.

A traditional Tesla loop which worked by Nikola Tesla as demonstrated in **Figure 1.2** contains two phases of voltage increment. The first is a traditional iron centre transformer that means up the accessible line voltage to a voltage in the scope of 12 to 50 kV, 60 Hz. The second is a thunderous air centre transformer (the Tesla coil) which ventures up the voltage to the scope of 200kV to 1 MV. The high voltage yield is at a recurrence a lot higher than 60 Hz, around 500 kHz for the little units and 80 kHz (or less) for the extremely huge units.

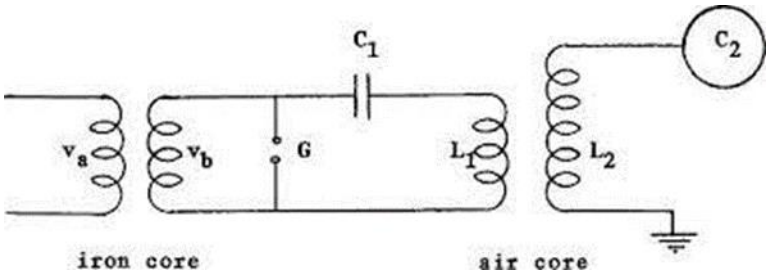

Figure 1.2: Traditional Tesla Coil

There were two generally regular of Tesla Coil circuit. The normal circuit in **Figure 1.3**, the spark gap short circuiting activity keeps high recurrence motions from "upholding" into the inventory transformer. In the other circuit, high plentifulness high recurrence motions that show up across the capacitor additionally are applied to the stockpile transformer's winding. This can incite crown releases between turns that debilitate, and at last obliterate, the transformer's protection.

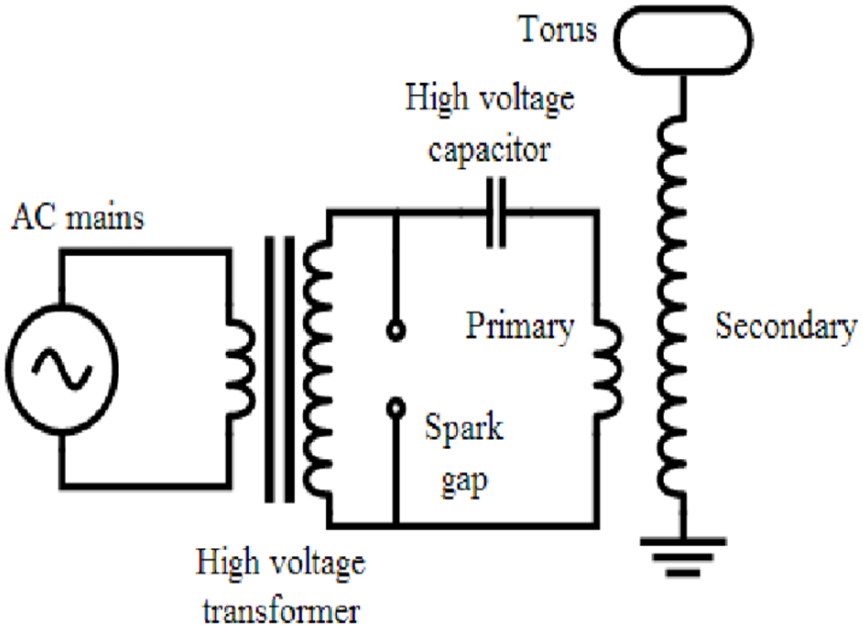

Figure 1.3: Typical Tesla Coil

In elective circuit configuration **Figure 1.4**, the Tesla Coil essential winding, spark gap, and tank capacitor are totally associated in arrangement. When the hole fires, the electrical conduct of either circuit is indistinguishable. Trials have shown that neither one of the circuits offers any stamped execution advantage versus the other.

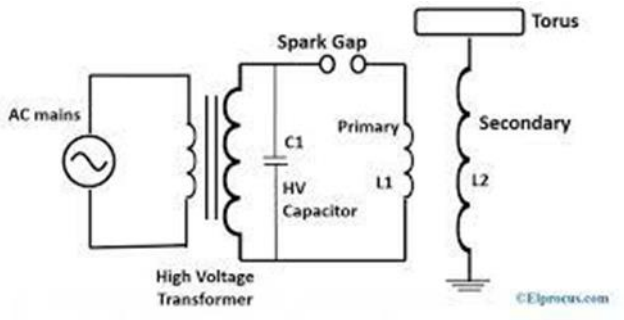

Figure 1.4: Modern Tesla Coil Circuit

2.2.1.1 Design Of Modern Tesla Coil

Having gone through various innovations as well as studies that have been conducted, there are various improvements that have been made to the Tesla Coil. From a traditional or classic design, now the design for the Tesla Coil has become simpler and more compact. **Figure 1.5** shows the Tesla Coil design among the latest.

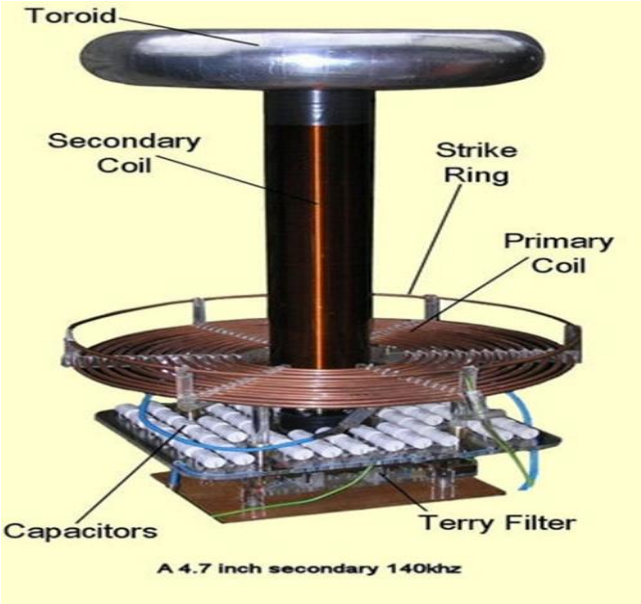

Figure 1.5: Design of Modern Tesla Coil

2.3 Tesla Coil Component

In this subchapter will describe the components used in implementing this project for the purpose of completing this thesis.

2.3.1 High Voltage Generator (Transformer)

In the work process to be carried out by the Tesla coil, there is an important element or a principle that is very important to ensure that the Tesla coil can work that is the Transformer. Transformer is one of the parts where according to simple interpretation and according to general understanding, Transformer serves as a medium to increase the current and also decrease the current. To increase the current, the Transformer is known as Step-up Transformer and to lower the current, it is known as Step-down Transformer.

The operation of a Transformer is required for some situations where for example, the supply of electricity distributed from the power generating station is in a very large amount and it is not suitable for the supply of residential areas. Therefore, to ensure that the supply can be used and distributed for residential areas, the authorities will use Step-down Transformer which aims to reduce the amount of current and indirectly serves to balance the amount of current that will be distributed to residential areas. If the balancing process is not