This report attached here was prepared by Siti Norazian Binti Mohd Asri in partial fulfillment for the Bachelor Degree Of Electronic Engineering (Industrial Electronic) is here by approved.

Signature : _____

Supervisor Name : En.Farid Arafat Bin Azidin

Date : 15105106

FARID ARAFAT BIN AZIDIN
Pensyarah
Fakulti Kejuruteraan Elektronik dan Kejuruteraan Komputer
Kolej Universiti Teknikal Kebangsaan Malaysia
Karung Berkunci 1200
Ayer Keroh, 75450 Melaka

METAL DETECTOR

SITI NORAZIAN BINTI MOHD ASRI

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Faculty Of Electronic And Computer Engineering
Kolej Universiti Teknikal Kebangsaan Malaysia

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"I here by admit that the paper is my own work except some of the parts which have been cited accordingly."

Signature : 

Author : **SITI NORAZIAN BINTI MOHD ASRI**

Date : **5 APRIL 2006**

I dedicate this book to my father and my mother, family members and last but not least, to all my K.U.T.K.M lecturers and friends.

ACKNOWLEDGEMENT

I would like to express my deepest gratitude to my academic and research advisor Mr Farid Arafat b. Azidin. Without his generous and constant support, I could not finish my final project about Metal Detector. My family and I are greatly indebted to him. He also gives me valuable suggestions on my thesis and providing me valuable information and help. Also, I would like to thank all the people around me in the class for their friendship and help. I would like to thank my friend Jim, Ahmad, Shahrul and Zakaria for constant help and encouragement. I wouldn't have been in this position if I hadn't had the support and best wishes from my family, especially my parents to whom I owe everything.

ABSTRACT

Nowadays, there are a lot of criminal incidents such as burglary. So, from this problem, a device is developed to detect such of the incident. This device is put in front of a house to detect the burglar. This device is called Metal Detector which is build from the combination of frequency, oscillator, filter, mixer, amplifier and other electronic components. This project is developed to detect metal like iron, nails, keys and coins which lost. The first step is to design the control circuit to detect different wave which has a different frequency. It is based on electromagnetic field which is produced by coil entwined at metal substance. It uses 'superheterodyne' principle where two different frequency waves are combined to produce one signal. This signal is transmitted to speaker by filter and amplifier.

ABSTRAK

Dewasa ini banyak berlaku kejadian jenayah seperti kecurian dan pecah rumah. Oleh itu, daripada masalah ini saya telah membangunkan satu alat yang boleh mengesan kejadian seperti ini. Alat ini akan diletakkan di pintu masuk rumah untuk mengesan penceroboh. Alat ini dinamakan Metal Detector yang dibina daripada gabungan frekuensi, oscillator, filter, mixer, amplifier dan komponen-komponen elektronik. Projek yang sedang dibangunkan ini juga berfungsi untuk mengesan segala logam seperti besi, paku, kunci dan syiling yang hilang samada di dalam rumput ataupun yang tertanam. Langkah pertama saya telah mereka bentuk litar kawalan bagi mengesan segala perubahan gelombang yang mempunyai frequency berlainan. Ia berdasarkan aruhan elektromegnetik yang terhasil apabila arus dialirkan melalui gegelung yang dililit pada bahan logam. Ia menggunakan prinsip 'superheterodyne' di mana dua gelombang yang berlainan frequensi bergabung untuk menghasilkan satu signal. Signal itu akan dihantar ke speaker melalui filter dan amplifier.

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CHAPTER I

INTRODUCTION

1.1 INTRODUCTION

What are Metal Detectors?

A metal detector is, simply, an electronic instrument used to locate specific types of metal. The capabilities of metal detectors vary according to the specific needs of the consumer. In addition to recreational purposes, metal detectors are used for airport and building security, event security, item recovery, archaeological exploration, and geological research. Metal detectors also come in several physical styles "beachcomber," hand-held, and mounted styles can all be effective for their intended use.

Hand-held detectors are smaller and less obtrusive than beachcomber detectors. They are also usually "powerful and sensitive enough to detect all concealed metal weapons, including the smallest knives and guns".

Mounted, or walk-through, detectors are not small, but they are even less invasive than the others since the person and/or items to be inspected need only to pass

through the detector without any close personal contact. These detectors have numerous sensors, each sensor's sensitivity rate being set at the proper level to detect specific metals and eliminate interferences such as "x-ray devices, video monitors and communications equipment" ("Walk-Through"). Mounted detectors are typically more expensive than the others, but they are built to endure high traffic, hard weather and rough handling ("Walk-Through").

Metal detectors are widely commercially available and are still the main tool used by deminers for manual demining activities. The metal detector is the only tool that is currently used. A metal detector consists of two coils; one transmits a low-frequency electromagnetic pulse while the other detects currents induced by metal objects. Traditional metal detectors mainly present the received signal energy in order to indicate the presence of metal. To reduce the false alarm rate, coil are being made at extracting further information from the signal other than just the energy

Today's metal detectors are sophisticated, but they still follow the same basic laws of physics. A coil of wire creates a magnetic field on one side of the detector. The other side also has a coil of wire that receives the magnetic field and creates a current. If there is any deviation, an alarm will sound. Usually, the detector is finding someone who forgot to remove their loose change, belt buckle, steel-toed boots, pen, money clip, camera, cell phone, pager, etc.

1.2 OBJECTIVE OF THE PROJECT

i. To design a device which can use to detect any changing frequency and output as alarm by speaker

ii. To detect metal substance, detection process is done using coil as an oscillator. When the metal is put near the coil, it will produce a magnetic field, so that it makes the frequency changes.

iii. To study how to developed a system of metal detector

iv. To know and familiarize the electronic components in terms of function, operation and the characteristic.

1.3 SCOPE OF THE PROJECT

The scope of project includes designing the electronic circuit used to detect the frequency using Superheterodyne principle. While developing this circuit, two types of RF oscillator are used like ceramic filter and Colpitt oscillator. Frequencies of each of the oscillator are 5.5MHz. First oscillator consists of transistor T1 (BF494) and ceramic filter 5.5MHz is commonly use to increase the IF sound at TV.

While Colpitt oscillator is build to support the transistor T3 (BF494) and inductor L1 which are connected in series with the Trimmer capacitor VC1. L1 is build using at least 15 rounded coils. Frequency of the first oscillator just now is Fx and Fy for the second frequency are combined with transistor T2 (BF494) which is called mixer. This combination of Fx and Fy will produce a new signal which it will pass into low pass filter to make the signal smooth the latter.

Signal will be tighten of by amplifier AF IC1 (2822M) to get the clearer output and then will be sent to speaker VR1. If Fx-Fy is 0MHz, so no sound is produced by the speaker. If Fx-Fy is more than 0MHz so the speaker will produces a sound.

1.4 PROJECT CONTRIBUTION

Generally, this project become as a role that is can give a contribution for all people with one system that were effective and accomplished to handle stolen, robbery and to using for finding something that were lost. This is because, this project were build using simple electronic circuit and not too big also having a high performance to protect people asset from stolen and to finding something lost.

CHAPTER II

METHODOLOGY

2.1 INTRODUCTION

This project determined the supposed step by step. The step is to learn the theory related, to understand project objective, circuit simulation and to learn the hardware to develop a circuit on to breadboard.

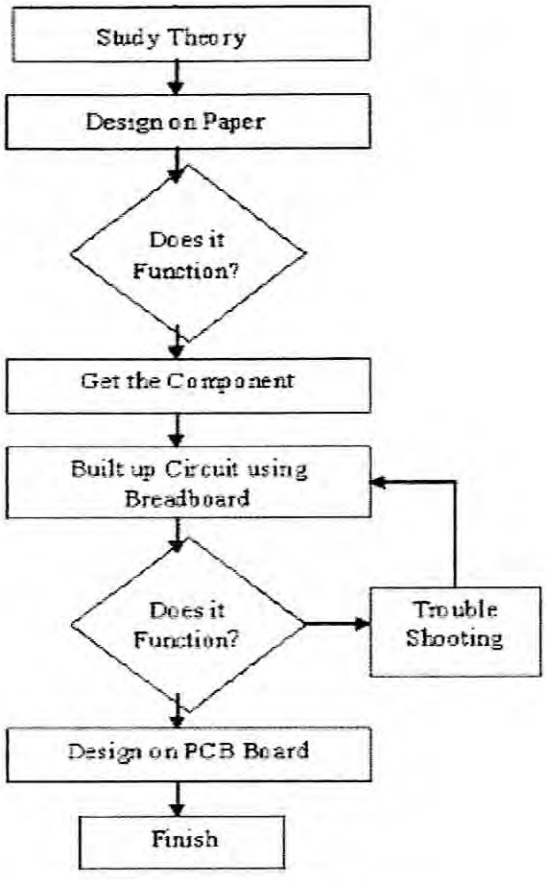

Figure 2.1: Flow Chart of Methodology Project

When the frequency wave Fx is combined with the frequency wave Fy at the same amplitude, a signal developed is 0MHz. If the frequency wave Fx is combined with the frequency wave Fy at the different amplitude, the signal will be produced. The signal produced will flow noise filter to make the signal smooth. Then the signal will flow into amplifier to strong signal.

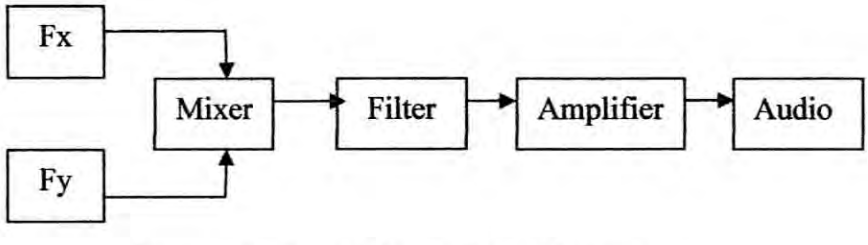

Figure 2.2: Signal Flow Block Diagram

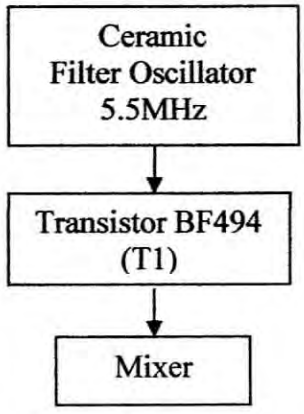

Figure 2.3: Ceramic Filter Oscillator Block Diagram

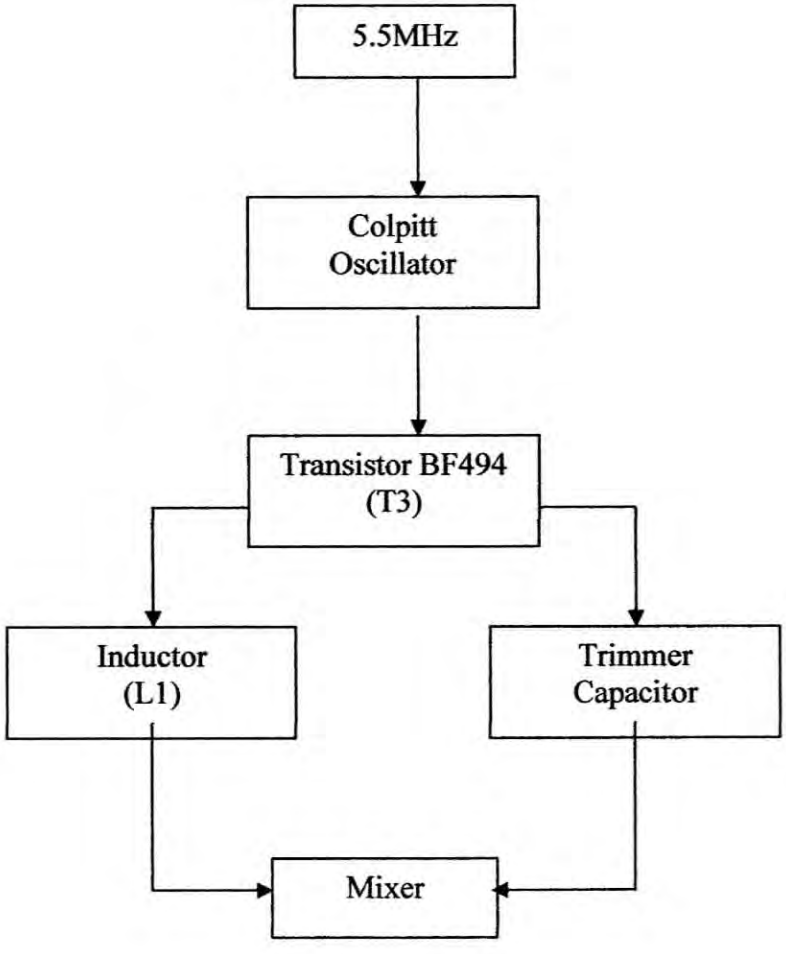

Figure 2.4: Colpitt Oscillator Block Diagram

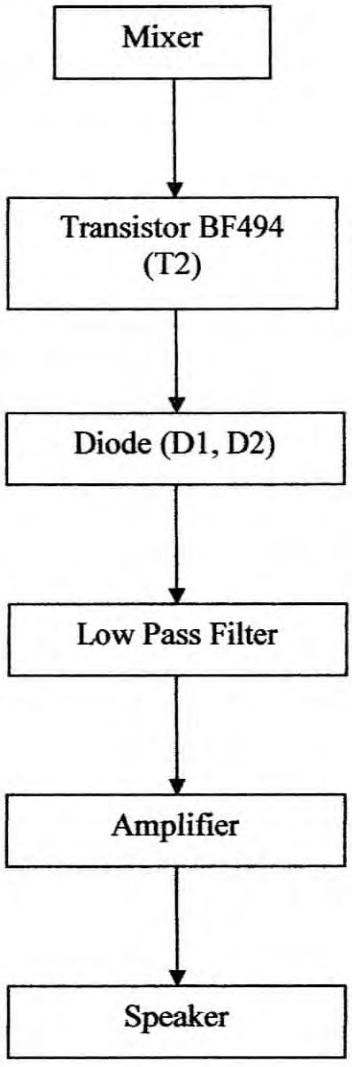

Figure 2.5: Fx+Fy Signal Block Diagram

2.2 ANALYSIS

Now, the Colpitt oscillator is being developed by software to get a 5.5MHz signal.

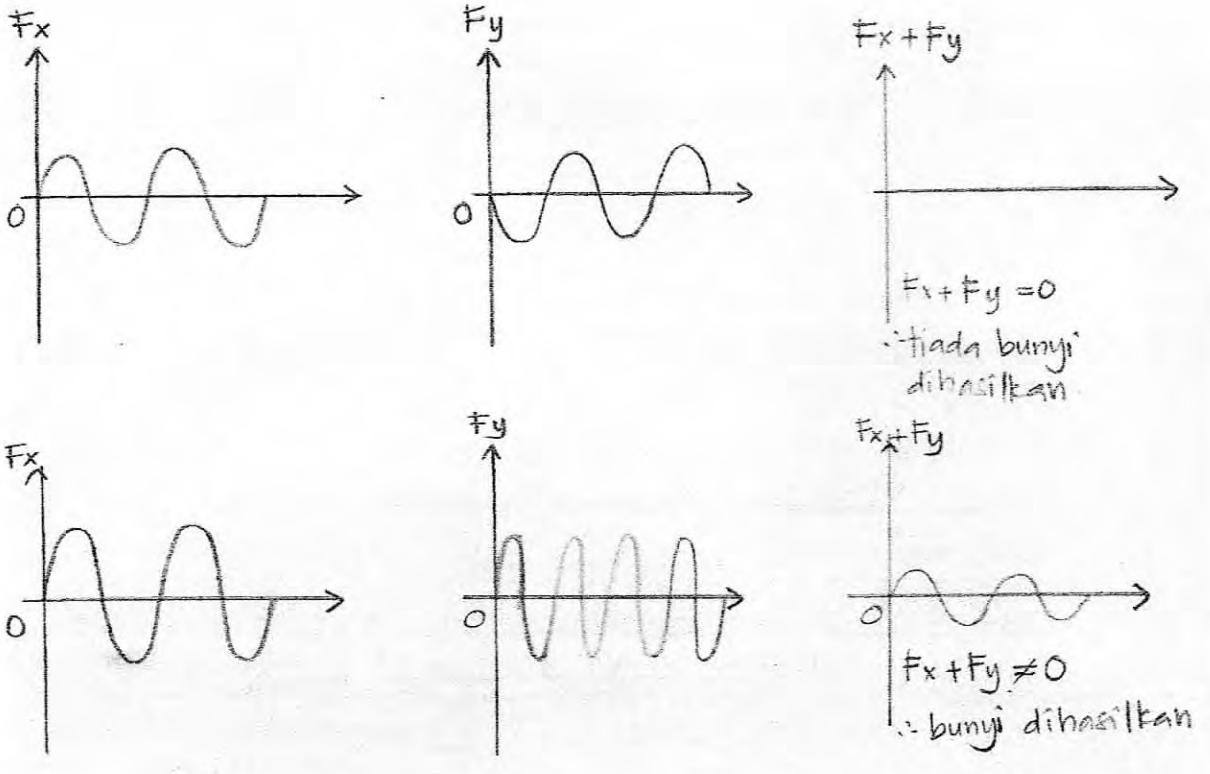

Figure 2.6: Frequency Combination

2.3 COLPITT OSCILLATOR USING SOFTWARE

The circuit for a Colpitt's Oscillator is shown in figure 2.7. The calculated simulation result of the output with the following data is also shown.

BJTy_11=3, C1=1e-4,
BJTy_12=2, C2=1e-5,
BJTy_21=1.5, C3=2e-6,
BJTy_22=2.4, C4=1e-5,
R1=4000, L=0.002,
R2=2000, Rf=0.001,
R3=1000, Vcc=50.

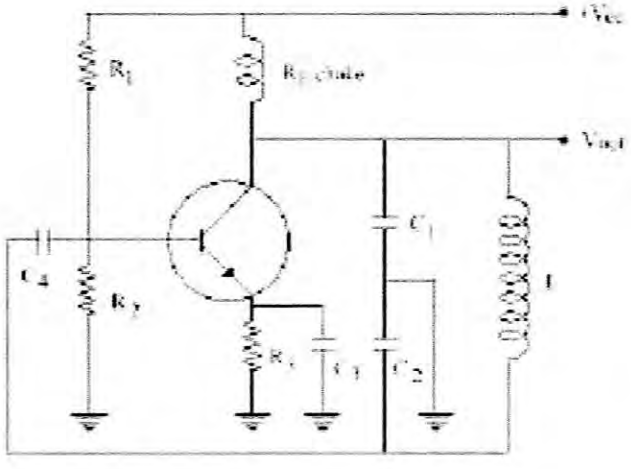

Figure 2.7: Basic Colpitt's Oscillator Circuit

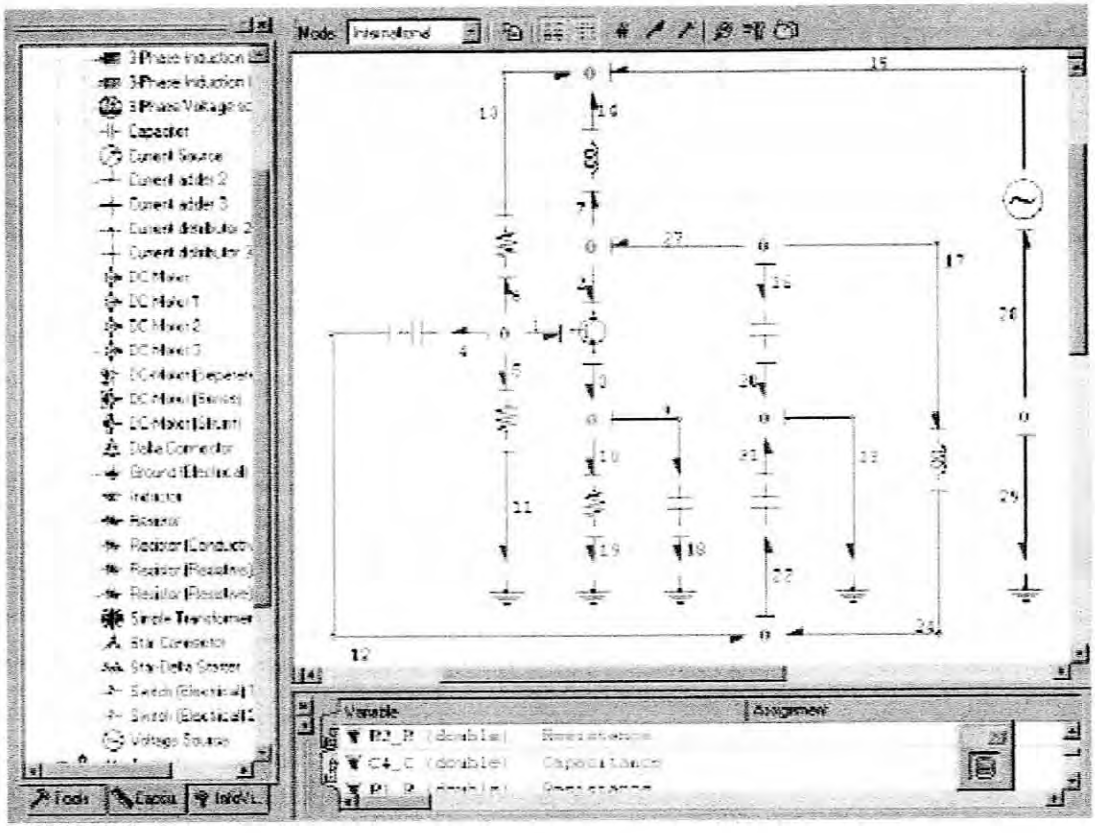

Figure 2.8: Colpitt's Oscillator Circuit Using Software

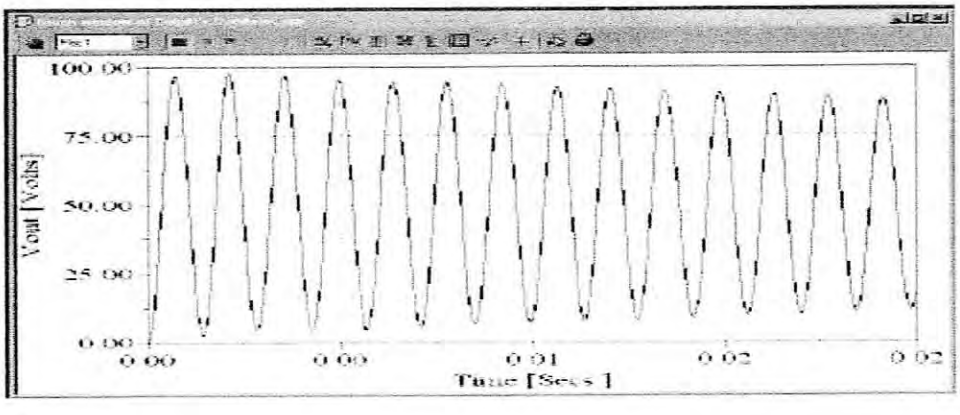

Figure 2.9: Colpitt's Oscillator Waveform