

PEST REPELLER SYSTEM

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BORANG PENGESAHAN STATUS LAPORAN
PROJEK SARJANA MUDA II

Tajuk Projek : PEST REPELLER SYSTEM

Sesi Pengajian :

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This project is dedicated
to my dearest parent,
Kushiar Bin Saian and Rodziah Bt Dahalan,
all my siblings, and not forget to my friends,
who have always sincerely pray for my
success and glory.
To my Supervisor,
Puan Nur Alisa Binti Ali
Thank you for your loving and taught so
that this task can be accomplished
successfully.

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ABSTRACT

This project presented the application of ultrasonic in repelling pest away and high voltage in killing pest. This pest repeller system is to drive away pest from our area. Getting rid of the pest is considered crucial since the hygiene of the pest can affect humans' health. The range of frequency is monitored since there are different pest using different range of frequency. Different range of frequency also will cause different reaction of pest's behavior since the received sound signals are dissimilar. Range of frequency from the ultrasonic transmitter is between 30 kHz to 70 kHz. High voltage weapon is applied in order to kill immune pest when they come through the repeller. This weapon will not harm human as very low current is used and the voltage produced up to 2 kV. In this thesis, data from theoretical, simulation and experimental are collected and analyzed.

ABSTRAK

Projek ini menerangkan tentang aplikasi gelombang bunyi ultrasonik dalam menghalau perosak dan aplikasi senjata voltan tinggi dalam membunuh perosak. Sistem penghalu perosak adalah untuk mengusir perosak dari kediaman kita. Menyingkirkan perosak adalah sangat penting disebabkan kotoran yang dibawa oleh perosak boleh menjejaskan kesihatan manusia. Nilai frekuensi di pantau kerana perosak berbeza menggunakan frekuensi yang berlainan. Nilai frekuensi yang berbeza juga menyebabkan tindak balas yang berbeza dari perosak kerana isyarat yang di terima berlainan. Nilai frekuensi yang diterima dari pemancar adalah dalam lingkungan 30 kHz hingga 70 kHz. Senjata voltan digunakan dalam usaha membunuh perosak yang kebal dengan pengusir apabila mereka melalui pengusir tersebut. Senjata ini tidak akan membahayakan manusia kerana arus yang sangat rendah digunakan dan voltan yang terhasil hanya 2 kV. Dalam tesis ini, data dari teori, simulasi dan experiment di kumpul dan dianalisa.

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CHAPTER I

INTRODUCTION

1.1 Background

As the world is emerging in various type of technology for better quality of life, electronic technology is used to repel pests has become more vital and significant as we are approaching the future. Even so, there are still so many types of pests that disturb human in their house, office, school, work place and so on. The purpose of this project is to make pest repeller or pest control which is used to dispose and kill all kind of pests from nearing human's habitations.

There are several methods for controlling insects and pest around homes, garages, and other structures. Trapping is the common and most effective method for controlling them. Traps can be used over and over again because trapping is less costly than poison baits that can easily find at market but more labor intensive. Traps can be set up indefinitely in areas where pest have been a problem such as rats problem which the best places are in secluded areas where the rats are likely to travel and seek shelter.

One of the alternatives to snap trap is a glue board. Glue board work on the same principle as flypaper. It stuck whatever that attempt to cross the glue board. However, this glue board may create additional problem for those who have pets like cat because cats may get into the glue and track it around the house. When there are

increasing number of pest around the building, user may need to use toxic baits to achieve adequate control. Toxic bait contains an active ingredient that works as either an anticoagulant, causing death by internal bleeding or as a direct toxic.

Pests bring many problems to the human being for centuries. Various methods like trapping, glue boards, toxic bait and others were used to kill the pests that infest our home. Those methods can be done but unfortunately, it will also make the human being in danger. Therefore, other technique that is much safer to human being is needed to repel those rodents away from our area. In this project, ultrasonic was chosen to evict away the pests.

Ultrasonic sensor has been successfully used in non-destructive testing and also widely used in medical imaging such in monitoring inside human body, fetus' health and breast cancer. But in real life, ultrasonic usage is not very familiar to drives the pests away. Moreover, this research is still in development stage.

This pest control is based on ultrasonic sound with combination high voltage generator or electroshock weapon. The ultrasound pest repelling system is widely available in the market. In this project it is proposed to investigate information on ultrasound repelling research and subsequently produce an electronic system for generating ultrasound to repel pest. The system should be configurable for various ultrasonic parameters to investigate the effectiveness of the configuration.

It is well known that pests like mice and rats are repelled by ultrasonic frequency between the ranges of 30 kHz to 50 kHz, which human beings cannot hear this high frequency of sounds. But all pests do not react at the same ultrasonic frequency, which some pests get repelled at 35 kHz to 40 kHz.

Three main components are being identified and going to be used in this circuit design which is IC 4017 (which is a well-known decade counter), IC 555, and IC 4013. The other components used are diodes, capacitors, resistors, amplifiers, and piezo tweeter.

Electroshock weapon technology uses a temporary high-voltage low-current electrical discharge to override the body's muscle-triggering mechanisms. The recipient is immobilized via two metal probes connected via metal wires to the electroshock device. The recipient feels pain, and can be momentarily paralyzed while an electric current is being applied. In terms of pest control, this is called electro-gun.

The internal circuits of most electroshock weapons are fairly simple, based on either an oscillator, resonant circuit, and step-up transformer or a diode-capacitor voltage multiplier to achieve the continuous, direct, or alternating high-voltage discharge. This electric shock weapon is only trigger when it sense a motion of any pest in front the repeller.

1.2 Problem Statement

This project designed to investigate information on ultrasound repelling research and subsequently produce an electronic system for generating ultrasound that can repel pest. This project also investigates the effectiveness of voltage electric applications on pest through electric weapon.

1.3 Objective

The objective of this project is to develop system containing repellent on pest together with application of high voltage on them.

1.4 Scope of Work

The scope of project is to do background study on the level of sound frequencies, designing the circuit, the operation of the repeller and the maximum distance for the device to function well. For the electric shock study, it is include the study of the high voltage generator and the effect of the electric shock. It is

important to determine the best and suitable technique to be implemented in this project except for the cheap costs. The circuit design must be prepared first before the hardware implementation. The main task that has to be completed is background study about sounds frequencies, high voltage electric shock, designing the circuit, constructing the hardware, testing and analyzing the performance of the device.

1.5 Methodology

The project flow chart show basic methodology and the overall processes for this project. The processes will be discusses more details in chapter 3.

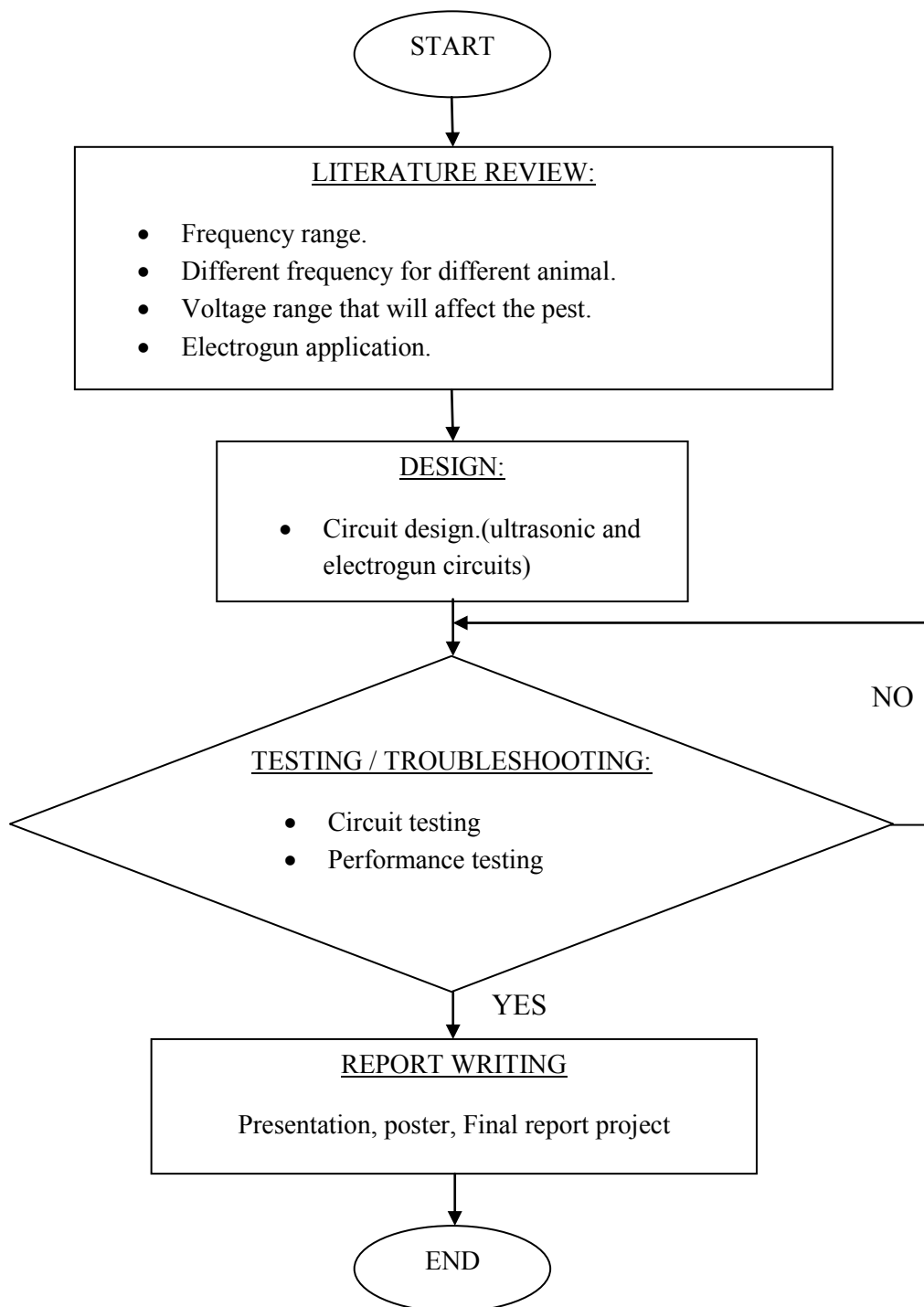


Figure 1.1: Flow Chart of overall project

CHAPTER II

LITERATURE REVIEW

2.1 Fundamental of Pest Repeller

Pest repeller refer to regulation or management of a species defined as pest, usually because it is perceived to be harm a person's health, the ecology or the economy. Pest control is one of three of the most simple yet effective methods you utilize in order to guard homes from unwanted and harmful creatures such as common house pest. Sanitation, Pest Control and Home Maintenances are the technique to reduce or remove these harmful and messy creatures.

According to the history timeline, the awareness of making a pest repeller began since Feb 1921 when the number of noxious mammal pests kept increased. On Feb 15 1924[1], a study of pests was conducted by Dr. Rudolfs in the hope of finding a chemical product which when applied to the skin will be repellent to mosquitoes without being offensive to human beings. Since then, many electronic products had been in the market before it then came out with a new technology called ultrasonic pest repeller. Ultrasonic pest repeller is a product which uses frequencies as a repellent without any chemical uses that can bring dangerous to humans' health.

The first manufacturer of pest repeller and piezo tweeter is in Taiwan, which is Taiwan Morris Co., Ltd which is located at Sanchuang City Taipei Hsien R.O.C since 1970. The company is specialized in ultrasonic pest repeller, security product and ceramic piezo tweeter.

2.2 Ultrasonic

Sound is defined as a form of electromagnetic energy produced by the mechanical vibration and propagates through air in the form of waves. The air near the source of mechanical vibration is compressed first which will create instability in the air column resulting in the movement of air in the form of a wave [2]. Sound and frequency of wave propagation are measured in terms of Decibel and Hertz respectively. The sound waves between 20 Hz and 20 kHz lies in the audible range and human can perceive only the audible portion of the sound waves. Sound waves below 20 Hz are called infrasonic sound and above 20 kHz is the Ultrasonic sound. Human ear is not sensitive to infrasonic and ultrasonic sound vibrations since human tympanum vibrates only to respond to sound vibrations within the range of 20 Hz and 20 kHz.

The production of ultrasonic is used in many different fields typically to penetrate a medium and measure the supply focused energy. The energy can reveal details about the inner structures of a medium, a property also used by animals such as bats for hunting. The most well known application of ultrasonic is its use in sonography to produce pictures of fetuses in human womb.

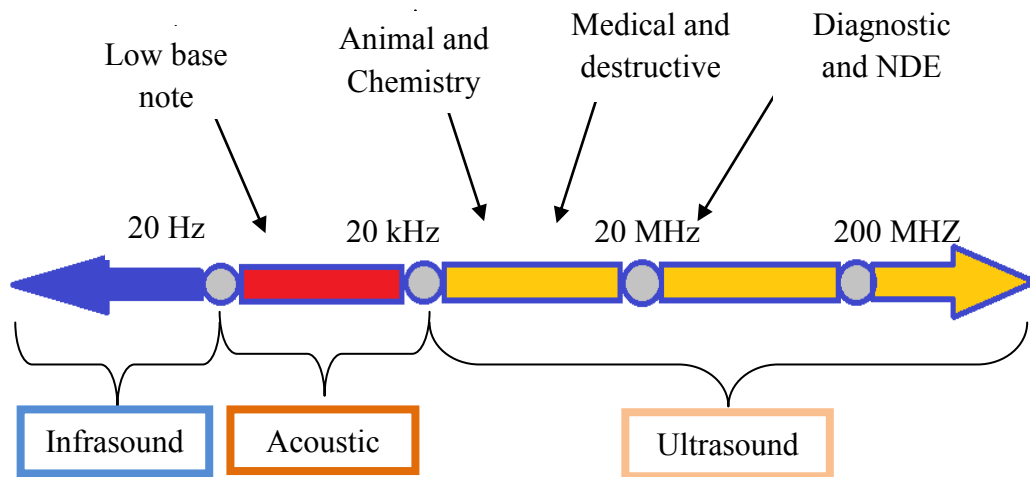


Figure 2.21: Approximate frequency ranges corresponding to ultrasound, with rough guide of some applications [3]

2.2.1 Frequency That Can Be Heard

The ear is an amazing body part because it enables humans and animals to hear what goes on around them [4]. Hearing is a family of senses with touch, sight, taste and smell where ears help the body to pick up sound waves and vibrations. Sound moving in waves through the air, the ground, and various other substances. Sound cannot be seen, but it can be felt by vibrations.

Hearing range usually describes the range of frequencies that can be heard by an animal or human, though it can also refer to the range of levels. There is considerable variation between individuals, especially at the high frequency end, where a gradual decline with age is considered normal. Sensitivity also varies a lot with frequency.

2.2.2 Human

People differ in their sensitivity to noise. The higher the pitch of the sound, the higher is the frequency. Young children, who generally have the best hearing, can often distinguish sounds from about 20 Hz, such as the lowest note on a large

pipe organ, to 20,000 Hz, such as the high shrill of a dog whistle that many people are unable to hear. The human hearing range is identified using an audiometer which emits sound waves of various frequencies and a calibrated headphone. Under such ideal conditions, the human ear can pick up the frequencies between 12 Hz to 20 kHz. There is a significant difference in the hearing ranges of men and women. It has been found that women are more sensitive towards higher range frequencies than their counterparts. The perception of lower range frequencies is more or less same in men and women.

Human speech, which ranges from 300 to 4,000 Hz, sounds louder to most people than noises at very high or very low frequencies. When hearing impairment begins, the high frequencies are usually lost first, which is why people with hearing loss often have difficulty hearing the high pitched voices of women and children and often have difficulty detecting differences between certain words that sound alike, especially words that contain S, F, SH, CH, H, or soft C sounds, because the sound of these consonants is in a much higher frequency range than vowels and other consonants.

Human can concentrate on listening at the time the tone is playing if do not pick a tone that is totally out of humans' audio range and the room where the tone is playing it is quiet. A really high pitch sound might be able to hear like an old CRT/tube TV or monitor turning on back in the days before flat panel monitors or human might feel a little bit of pressure in their head.

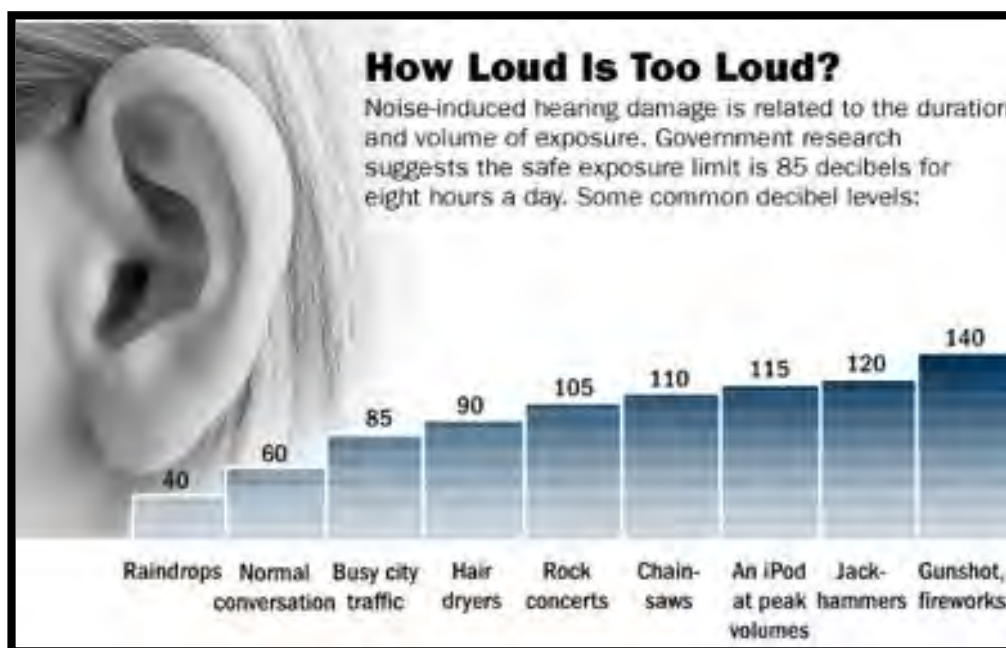


Figure 2.2.21: Dangerous decibels for human [9]

2.2.3 Rats

A rat's hearing is more sensitive than human which is the softer sound. Rats can hear ultrasound in the range of around 200 Hz to 80 or 90 kHz (Fay 1988, Kelly and Masterson 1977, Warfield 1973) which human cannot hear because this frequency is above the range of human perception. There is a whole world of high frequency sound out there that rats can hear that we cannot, a perceptual difference that humans tend to forget (Milligan. 1993, Sales. 1998) [6]. For example, when a human gently rubs thumb and forefinger together, we hear nothing but this movement makes a scratchy sound in the ultrasonic range. Wire cages make a lot of ultrasonic noise in addition to audible noise when rats move around in them.

Rats also emit short, high-pitched calls under positive contexts. Adults and juveniles emit them during rough and tumble play (Knutson 1998, Burgdorf and Panksepp 2001, Panksepp and Burgdorf 1998), and in anticipation of feeding (Burgdorf 2000). Male and female rats also call in a sexual context (Barfield 1979). Before copulation, males and females emit such calls as they approach and sniff each