© February 2017 | IJIRT | Volume 3 Issue 9 | ISSN: 2349-6002

Design Considerations of Mosquito repellent unit

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***Abstract-* The basis of the project is to design an ultrasonic pest repellent. This kind of device will also be very useful to counter the various problems prompted with the aid of ants, bugs, pests, rodents, and many others. The gadget is compact, inexpensive, and it does no longer motive any pollution in contrast to the opposite chemical repellents. Now we have used a microcontroller to generate sweep in sound frequencies, and an meeting including audio power amplifier, speaker and lcd for this validation. The technical important points of this task follow later. The circuit has been experimentally tested on ants, bugs, and small insects, and it has been effective in repelling them by means of the iteration of ultrasonic frequency sound.**

Index Terms- **TPA.**

I. INTRODUCTION

It is possible that pests like insects, ants, rats, mice etc. are repelled by ultrasonic frequency in the range of 30 kHz to 50 kHz. Human beings can't hear these high-frequency sounds. Our project repels pests by emitting pulse ultrasonic waves. Using ultrasonic waves creates a noisy and hostile environment which repels pests, whilst remaining absolutely safe for humans and household animals. Unfortunately, all pests do not react at the same ultrasonic frequency. While some pests get repelled at 35 kHz, some others get repelled at 38 to 40 kHz or even higher frequencies. Thus to increase the effectiveness, frequency of ultrasonic oscillator has to be continuously varied between certain limits. Frequency of emission of ultrasonic sound is continuously varied by our product in different patterns to repel different insects. Mostly, this vapours attack the brain through lungs and skin as well as other living beings by small or greater percentage.Here is a circuit that automatically switch on/off the mosquito repellent after present time interval, thus controlling the release of toxic vapours into the room. the circuit turns the mosquito repellent on for approximately 20 minutes scheme. then process of on and off occurs repeatedly.

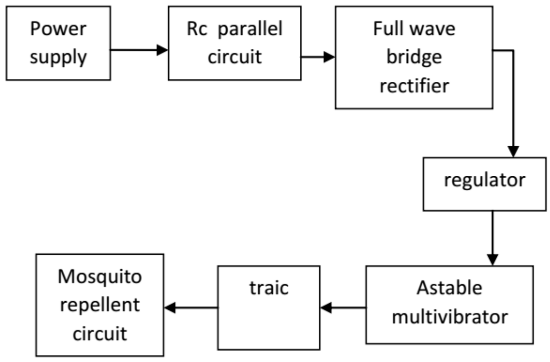

Fig.1 Block Diagram of automatic on/off mosquito repellent

The main aim of this project is periodically on/off mosquito repellent circuit. The device mainly consist of lm555 timer, full wave bridge rectifier, zener diode, led and triac. The bridge rectifier is used for convert ac power supply into pulsating dc power. The zener diode is used for the voltage regulation purpose and capacitor is used for provide a pure dc supply to LM555 timer in this circuit we use lm555 ic in astable multivibrator configuration. The periodically on/off of circuit is controlled by LM555 timer.

II. RELATED WORKS

Electronic pest control is the name given to the use of any of the several types of electrically powered devices designed to repel or eliminate pests, usually rodents or insects. There are basically two types of electronic pest control devices widely available, these are Ultrasonic and Electromagnetic.

Ultrasonic devices operate by emitting short wavelength, high frequency sound waves too high in pitch to be heard by the human ear (all frequencies greater than 20,000 Hz). This is due to limitations in human hearing. Humans cannot hear ultrasound because the eardrum does not vibrate fast enough, but some animals such as dogs, bats and rodents can hear well into the ultrasonic range. Some insects, such as grasshoppers and locusts can

detect frequencies from 50,000 Hz to 100,000 Hz, and moths and lacewings can detect ultrasound as high as 240,000 Hz produced by insect-hunting bats.
Insects detect sound by special hairs or sensilla located on the antennae (mosquitoes) or genitalia (cockroaches), or by more complicated tympanal organs (grasshoppers, locusts, moths and butterflies). "Ultrasound and Arthropod Pest Control"[1] an extensive Kansas State University study confirmed that ultrasonic sound devices do have both a repellent effect as well as a reduction in mating and reproduction of various insects. However, the results were mixed and ultrasonic sound had little or no effect on some pests. Various ultrasonic devices where highly effective on crickets while the same devices had little or no repellent effect on cockroaches. Additionally the results where mixed with some devices being effective while others having no effect depending on the test subject. The study also concluded there was no effect on ants or spiders in any of the tests. They concluded, based on the mixed results, that more research is needed to improve these devices.

A 2002 study by Genesis Laboratories Inc. does lend some credence to the ability of electronic repellent devices to repel certain pests in controlled environments. “Preliminary study of white-footed mice behavior in the test apparatus demonstrated a significant preference for the non-activated chamber among both sexes.” Cockroaches initially respond to electronic pest control devices by moving about a bit more than usual, but don't appear overly eager to escape from the sound waves. This includes devices that emit uniform frequency as well as changing frequencies of ultrasound. Rodents adjust to the ultrasound (or any new sound) and eventually ignore it. However, researchers were able to use the increased cockroach activity to good effect by increasing the rate they caught the roaches in sticky traps. Tests of commercial ultrasonic devices have indicated that rodents may be repelled from the immediate area of the ultrasound device for a few minutes to a few days. Other tests have shown that the degree of repellence depends on the frequency, intensity, and the preexisting condition of the rodent infestation. The intensity of such sounds must be so great that damage to humans or domestic animals would also be likely. Commercial ultrasonic pest control devices do not produce sounds of such intensity.

III. DESIGN APPROACH

We are using an LM 380 audio power amplifier circuit to design the system capable of producing sound in the frequency range of upto 80 kHz. A speaker of appropriate frequency range is used to transmit these sound waves. We are using a separate power module to power the system. We are using the Atmega–16 microcontroller to produce the different patterns of frequencies which we require in our experimentations, and an LCD keyboard assembly to track and control this ongoing process. We have programmed the Atmega-16 microcontroller so that it generates the different patterns of frequency sweeps in its different modes. Akeyboard is also provided in the system, so that any of these different modes can be selected by the user.

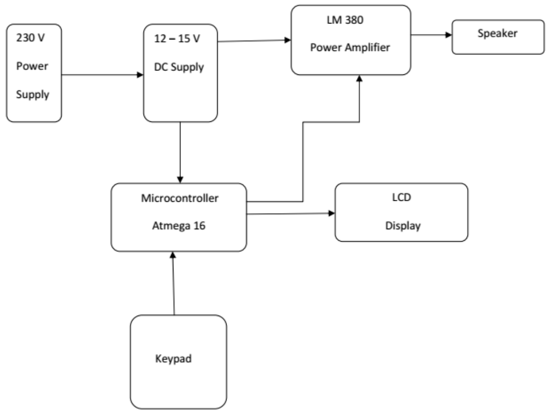

Fig.2 The above block diagram describes the basic layout of our circuit.

A. LM 380 Ultrasonic Tranducer

We are using LM 380 ultrasonic transducer as the amplifier of our circuit. This is a 2.5 W audio power amplifier. Its gain is internally fixed at 34 dB. Some of its important features are :-
o Supply voltage - 10V to 22 V
o Peak current - 1.3 A
o Minimum output power (rms) - 2.5 W (RL= 8Ω; THD = 3 %)
o Av (Gain) - 40 – 60 V/V
o Typical Av - 50 V/V
o Zin (Input Resistance) - 150 kΩ
o Bandwidth - 100 kHz

B. ATmega16 microcontroller

ATmega16 is an 8-bit high performance microcontroller of Atmel’s Mega AVR family with low power consumption. Atmega16 is based on enhanced RISC (Reduced Instruction Set

Computing, Know more about RISC and CISC Architecture) architecture with 131 powerful instructions. Most of the instructions execute in one machine cycle. Atmega16 can work on a maximum frequency of 16MHz. ATmega16 has 16 KB programmable flash memory, static RAM of 1 KB and EEPROM of 512 Bytes. The endurance cycle of flash memory and EEPROM is 10,000 and 100,000, respectively. ATmega16 is a 40 pin microcontroller. There are 32 I/O (input/output) lines which are divided into four 8-bit ports designated as PORTA, PORTB, PORTC and PORTD. ATmega16 has various in-built peripherals like USART, ADC, Analog Comparator, SPI, JTAG etc. Each I/O pin has an alternative task related to in-built peripherals.

C. LM 7805 Voltage Regulator

The LM78XX series of three terminal regulators is available with several fixed output voltages making them useful in a wide range of applications. One of these is local on card regulation, eliminating the distribution problems associated with single point regulation. The voltages available allow these regulators to be used in logic systems, instrumentation, HiFi, and other solid state electronic equipment. Although designed primarily as fixed voltage regulators, these devices can be used with external components to obtain adjustable voltages and currents.

D. Keypad

We are using the 4x4 standard keypad to give input to the microcontroller.

IV. WORKING DESCRIPTION

The circuit can be divided into these basic components.

Power Source Converter: It converts a 230V, 50 Hz supply into a 12-15 V DC supply. The circuit diagram is shown below.

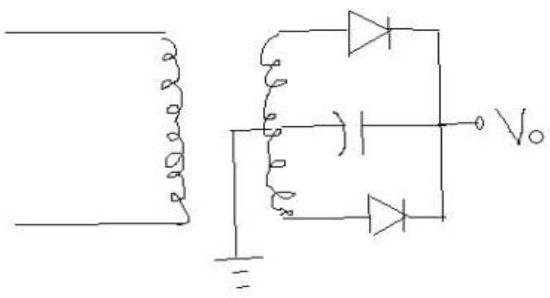

Fig. 7 – Power Source Converter

Audio power amplifier: It takes 1 V p-p square wave input generated from the microcontroller unit and gives an amplified signal to the speaker. The LM380 IC used is a 2.5 W audio amplifier. The output of the amplifier was measured using an ultrasonic receiver circuit during testing stages, and the gain was found to remain almost constant upto 80 KHz, a range conveniently suited to our needs. The circuit diagram of the amplifier circuit is shown below :

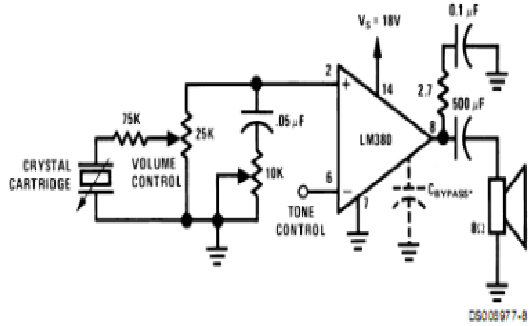

Fig. 8 – Phono Amplifier Circuit Diagram

Microcontroller: The microcontroller unit can operate in various modes depending on user input. In each mode the microcontroller generates a square wave signal at port D whose frequency varies continuously in a set range. This ensures that the sound output continuously changes and the pest doesn't get used to the sound.

Frequency generation: We use timer in CTC mode to generate the square wave. The timer interrupts are enabled. So on every timer compare with the OCR1A value, the internal interrupt is triggered which toggles the D0 bit. To enable continous variation of frequency the value of the OCR1A register is continuously changed after 10000 pulses. This is included in the ISR routine of the timer.

V. CONCLUSION

We tested the circuit on a small rat, which was within an enclosed metallic cage. The problem is that when the rat moves around the cage, the natural vibrations of the cage itself are in the ultrasonic range. When we turned on our circuit, the rat in some cases, would move away from the source of the noise, in other cases, it would 'freeze', where it would not move at all. This was around the frequencies of 40 – 45 kHz. Apparently, the rat would get irritated, when the circuit was turned on. We also found on internet that rats are repelled at around 40-45 kHz.

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