Mosquito Repellent Circuit
(Generate a frequency Range Between 20-38 Khz)

Suchandana Roy Saha, Dhrubojyoti Ghosh, Koustuva Kanti Mandal

Abstract— **Control of mosquitoes is something of utmost importance in the present day with rising number of mosquito borne illnesses. Specialty products like mosquito repellent used to combat mosquitoes are required. This project proposal presents the design and testing of an electronic mosquito repellent. The project is aimed at developing a device that is capable of emitting ultrasonic energy of varied frequencies. These frequencies do affect the auditory senses of pests such as mosquitoes, rodents, avian and nocturnal insects by making them uncomfortable in their abode. However these frequencies do not affect the hearing ability of humans. This electronic mosquito repellent is based on the 555 timer IC is a simple and useful mosquito repellent .The mosquito repellent circuit generates an ultrasonic sound with a high output frequency 20-38 kHz that allows spreading mosquitoes within a wide radius . The circuit is quite simple and required few external components. The oscillation frequency is given by the value of the resistor and a capacitor component.**

Keyword—555 Timers, Astable Multivibrator, Buzzer, Frequency, Resistor, Capacitor.

I. INTRODUCTION

Human beings can hear sound in the range of 20 Hz to 20 kHz. Sound of any frequency above 20 kHz is termed as ultrasonic sound. Several animals like cats, dogs, insects, mosquitoes have the feature of being able to hear this ultrasonic sound. In mosquitoes, this feature is attributed to the presence of sensory structures in their antennae. Usually ultrasound is transmitted by male mosquitoes and received by female mosquitoes. However after breeding, female mosquitoes generally avoid the ultrasound and this fact can be used to produce ultrasound in a range similar to that produced by male mosquitoes and repel away the mosquitoes. The ultrasound produces a stress on the antenna of the mosquitoes and repels them away.In other words, a simple circuit is designed which can produce ultrasound in the frequency range of 20 kHz to 38 kHz, which can scare away mosquitoes.

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II. CIRCUIT DETAILS

The basic idea behind developing the circuit is to use a buzzer to produce ultrasound. The buzzer is driven by an oscillator circuit. Here, we are using a 555 Timer based astable multivibrator circuit [1] as the oscillator circuit.Designing the circuit involves designing an astable multivibrator circuit. Generally, frequency of output signal produced by a 555 astablemultivibrator is given by:$F = 1.44/ ((Ra+Rb*2)*C)$. Here (fig 1.) Ra is the value of resistor between pin 7 and Vcc, Rb is value of resistor between pins 7 and 6 and C is value of capacitor between pin 6 and ground. Let C = 0.01 microfarad, F = 38 kHz. Let Duty Cycle, D = 60% (It is not possible to get 555 timers to produce signal with 50% duty cycle.This gives,$Ra = 1.44(2D-1)/ (F*C)$And $Rb=1.44(1-D)/ (F*C)$Substituting values of C, F and D, we getRa = 0.758 K Ohms, i.e. 758 Ohms and Rb = 1.52 K OhmsThus, we can use a resistor of 760 Ohms and another resistor of 1.5 K. Here a potentiometer of 1 K is used[2].
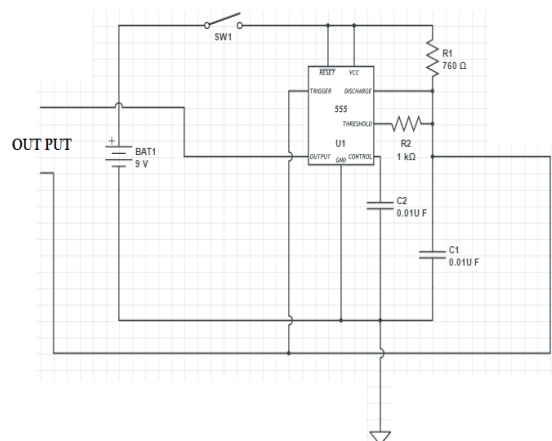

Figure 1. Mosquito Repellent Circuit

2.1 Timer circuit

The most common form of Astable multivibrator (fig 2.) is 555 Timer IC. It is basically an 8 pin IC [2]. Pin1 – Ground pin, which is directly connected to the negative terminal of the battery. Pin2-Trigger Pin. It is an active low pin. The timer is triggered when signal at this pin is less than one third of supply voltage. For astable operation this pin is connected directly to pin no.6. Pin 3 – It is the output pin. Pin 4 – It is the reset pin. It is an active low pin. It is usually connected to positive rail of the battery. Pin 5 – It is the control pin and is seldom used. For safety purpose, this pin is connected to ground through a 0.01microFarad ceramic capacitor. Pin 6 – It is the threshold pin. The timer output is back to its stable state when voltage at this pin is greater than or equal to two-third of supply voltage. For astable operation, this pin is shorted to pin 2 and connected to pin 7 using a resistor. Pin 7 – It is the discharge pin and provides the discharge path for the capacitor[3].
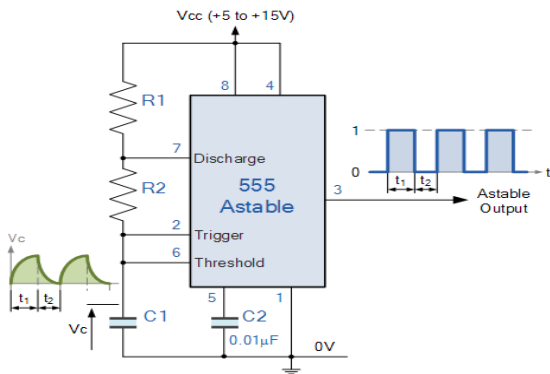
Figure 2.Astabl multivibrator

In the 555 Oscillator circuit above, pin 2 and pin 6 are connected together allowing the circuit to re-trigger itself on each and every cycle allowing it to operate as a free running oscillator. During each cycle capacitor, C charges up through both timing resistors, R1 and R2 but discharges itself only through resistor, R2 as the other side of R2 is connected to the discharge terminal, pin 7. Then the capacitor charges up to 2/3Vcc (the upper comparator limit) which is determined by the 0.693(R1+R2) C combination and discharges itself down to 1/3Vcc (the lower comparator limit) determined by the 0.693(R2.C) combination[1]. This results in an output waveform whose voltage level is approximately equal to Vcc – 1.5V and whose output "ON" and "OFF" time periods are determined by the capacitor and resistors combinations[3].

2.2 Circuit operation

Once the switch is closed (fig 1.), the 555 timer gets the power supply. As per the inner circuit, initially the capacitor voltage will be zero and hence voltage at threshold and trigger pin will be zero. As the capacitor charges through resistors Ra and Rb, at a certain point voltage at threshold pin is less than the capacitor voltage. This causes a change in timer output. The capacitor now starts discharging through resistor Rb, i.e. the discharge pin and continues so until the output voltage is back to the original[2]. Thus the output signal is an oscillating signal with frequency 38 KHz. The output from this astable multivibrator circuit drives a 38 KHz piezo buzzer, producing ultrasound at regular repetitions. On varying the value of potentiometer, the output frequency can also be varied.

III. RESULT

First analysis the waveform of the circuit by using pspice [3] and calculate the oscillation frequency of output waveform is 38 kHz (fig 3.).
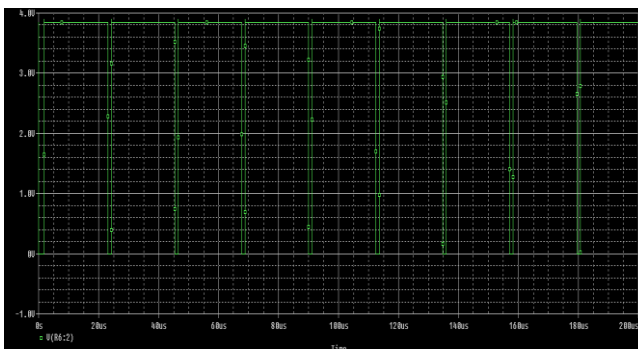

Figure 3.Output waveform using pspice

IV. CONCLUSION

Use either SI (MKS) or CGS as primary units. (SI units are strongly encouraged.) English units may be used as secondary units (in parentheses). **This applies to papers in data storage.** For example, write "15 Gb/cm^2 (100 Gb/in^2)." An exception is when English units are used as identifiers in trade, such as "3½ in disk drive." Avoid combining SI and CGS units, such as current in amperes and magnetic field in oersteds. This often leads to confusion because equations do not balance dimensionally. If you must use mixed units, clearly state the units for each quantity in an equation.

The SI unit for magnetic field strength H is A/m. However, if you wish to use units of T, either refer to magnetic flux density B or magnetic field strength symbolized as $\mu_0 H$. Use the center dot to separate compound units, e.g., "A·m^2."

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BIBLIOGRAPHY

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