MOSQUITO REPELLENT CIRCUIT

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Abstract **-- This paper proposes an effective Mosquito Repellent circuit model to maintain high frequency which makes ultra-sound. In recent years, The escalating dengue and chikungunya situation in Bangladesh has emerged as a serious public health problem in terms of morbidity and mortality. Analyzing data of recent survey shows how people are being affected by these diseases. People used several kinds Mosquito repeller such as coil, lotion and chemical based Spray which are not enough effective and environment friendly and also very costly. Numerous studies shows that our proposed project that is capable of emitting ultrasonic energy of varied frequency that repels or eliminates mosquitos, is more effective, economical and, environment friendly. The emitting ultrasound of output high frequency(20kHz to 38kHz) do affect the auditory senses of mosquitoes ,however do not make any harm haring ability of human. The circuit can be made by using the components are Resistor, capacitor, 555 timer, buzzer, switch , battery which are available and cheap.**

I. Introduction

Recently, some theories by scientist says that insects like mosquitoes find particular frequencies of sound very unpleasant and run away from these frequencies. these theories also says normally male mosquitoes can transmit sound of these frequencies which are received by female mosquitoes but during the time of breeding, female mosquitoes tend to avoid sound in these frequencies.

It seems quite obvious then, that by creating these insects' frequencies electronically, we should be able to repel these insects!

The most important point to remember here is that, human beings can listen to sound in range of 20Hz-20KHz but can't hear above this range. Whereas 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 however male mosquitoes transmit ultrasound of(>20KHz) this range.[2]
Consequently, the circuit we have made produce ultrasound in the range of 20KHz - 38KHz that scare away mosquitoes.

II. LITERATURE REVIEW

The writing survey of this postulation is partitioned into two sections.

Mosquito transmitted disease is major cause for all Human loss with 700 million people suffering annually. (taubes 1997). According to recent research it is noticed that half of the world's population will be in-trouble shortly if there is no action taken regarding mosquitoes. A outburst of chikungunya had occurred in the year between leaving behind many deaths occurring in the country. Almost 5.5 billion people are living in the malaria risk area around which 4.5 billion people suffer every year. The situation is one very complicated in recent years as said by research of The United States.

This device has the potential to eliminate mosquitoes. This circuit or project can be helpful in domestic area by keeping the mosquitoes away using a high frequency sound produced by the circuit. For the success of this project, proper method to design and construct the circuit has been taken into consideration. Proteus 8 Professional software simulation tool is used to simulate the circuit inside a computer. After that, the circuit is connected to a breadboard to test run the project before transferring the circuit to a circuit board.

III. METHODOLOGY

1. Implementation setup

In this project, we have used several components and details about them are given:

A) For breadboard connection:

1.555 IC timer:

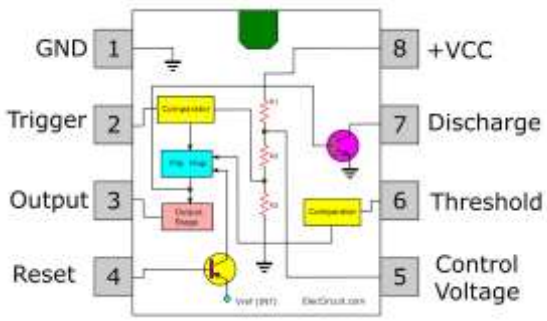


Figure 1:555-IC Timer

555 pin#	Pin name	Pin description
1	GND	Ground supply: this pin is the ground reference voltage (zero volts).
2	TRIGGER	when $V_{TRIGGER}$ falls below ½ $V_{CONTROL}$ OUTPUT goes to the high state and a timing interval starts. As long as TRIGGER continues to be kept at a low voltage, OUTPUT will remain in the high state.
3	OUTPUT	Output: this pin is a push-pull
4	RESET	It's an active low pin .If this pin is not used, it should be connected to V_{CC} .
5	CONTROL	this pin provides access to the internal voltage divider .If this pin is not used, it should be connected to a decoupling capacitor.
6	THRESHOLD	this pin is shorted to pin 2 and connected to pin 7 using a resistor.

7	DISCHARGE	This pin is an open-collecto provides the discharge path f the capacitor.
8	V_{CC}	Positive supply: the suppl voltage range is typically 4.5 16 volts

2) Piezo Buzzer.

A piezo buzzer is a type of electronic device that's used to produce a tone, alarm or sound. It's lightweight with a simple construction, and it's typically a low-cost product. in order to produce sound the piezo ceramic disc needs oscillations of high voltage. When a small DC voltage is applied to the input pins, it is first converted to an oscillating signal using the combination of resistor and transistor. These oscillating signals are amplified using the inductor coil. When high voltage alternating signals are applied to the piezo ceramic disc, it causes mechanical expansion and contraction in radial direction. This causes the metal plate to bend in opposite direction. When metal plate bends and shrinks in opposite direction continuously it produces sound waves in the a air.

Figure 2: Buzzer

3) Capacitor

A capacitor is a passive device with two terminals, capable of storing electrical energy in an electric field, much like a small rechargeable battery. It blocks direct current and allows alternating current to pass through it. It usually has two metal plates on which electrical charges of opposite nature are induced. they are separated by non-conductive region or an electrical insulator material known as a dielectric. These two plates are used to store charge in between them. An ideal capacitor is characterized by a constant capacitance *C*, in farads in the SI system of units, defined as the ratio of the positive or negative charge *Q* on each conductor to the voltage *V* between them.

4) Resistor

A resistor is a passive two-terminal electrical component that implements electrical resistance as a circuit element. In electronic circuits, resistors are used to reduce current flow, adjust signal levels. In this project ,we used one 1KOhm and another 0.6KOhm resistor.

5)Switch

A switch is an electrical component that can disconnect or connect the conducting path in an electrical circuit, interrupting the electric current or diverting it from one conductor to another**.**

B) For PCB Designing :

1) CCB board

2) Glossy paper

3) Ferric Chloride

4) Laser Printer

5) Drilling Machine

6) Soldering Machine

C) Breadboard Connection implementation

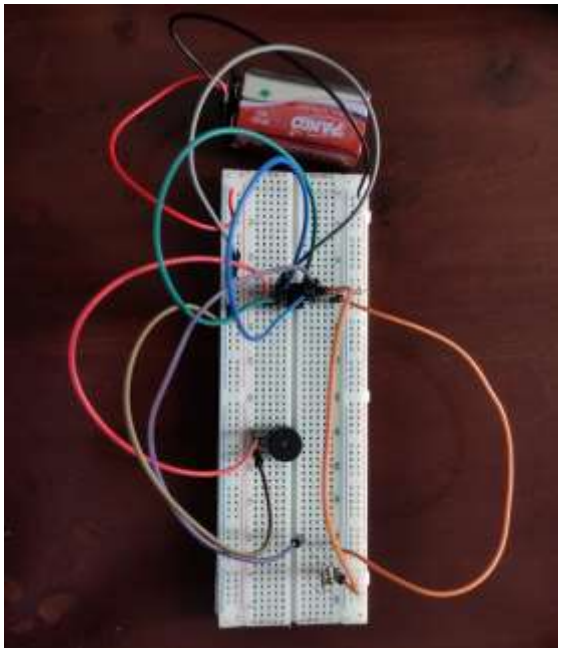
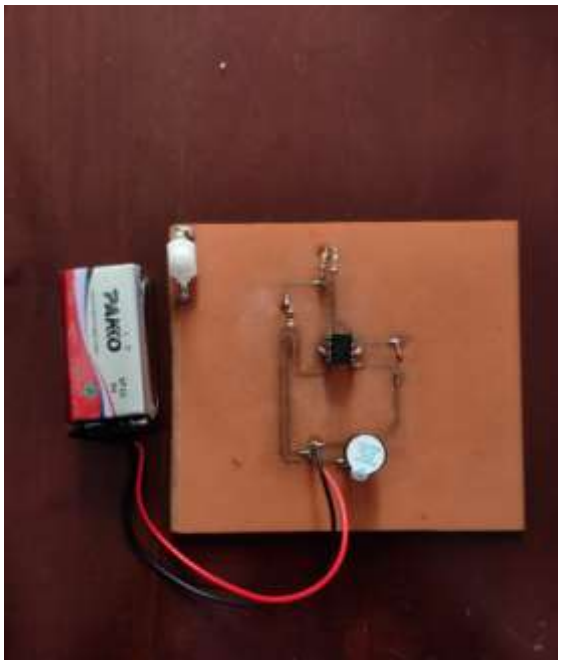


Figure 3: Breadboard implementation of the project

D) PCB Design implementation:



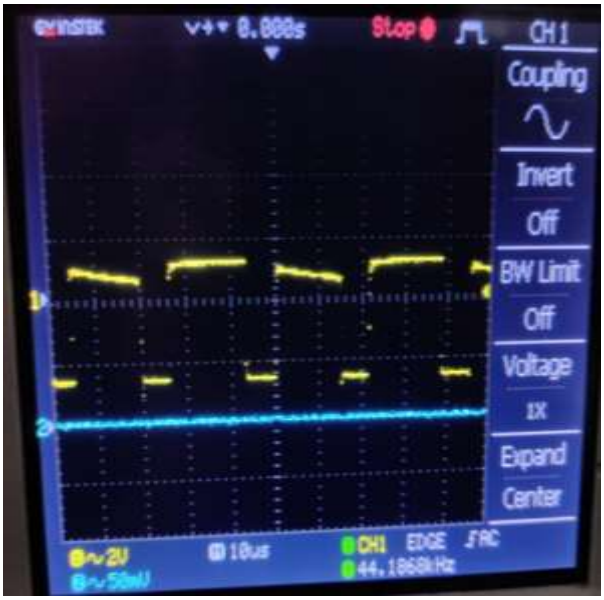


Figure 4: Final PCB implementation of the project.

2. Working principle

1.In this project , our approach is to make a mosquito repellent circuit that will generate an ultrasonic sound of above 20KHz . at first we have to calculate the exact oscillation frequency which is 43KHz .The oscillation frequency is given by the value of the resistors and capacitors components and can be modified changing the value of the components. The buzzer that we are using is driven by an oscillator circuit. Here , we are using a 555 timer based a stable multivariable circuit as the oscillator circuit.[3] The oscillation frequency is calculated with the following formula:

$$F = \frac{1}{0.67 \times (R_1 + 2 \times R_2) \times C}$$

3. Once the switch is close, 555 timer gets the power supply . Initially, the capacitor voltage will be zero and hence voltage at threshold and trigger pin will

be zero.as the capacitors charges through resistors R1 and R2, at a certain point voltage at threshold pin is less than the capacitor voltage .this causes a change in timer output.the capacitors now starts discharging through resistance R2 . the the output voltage is back to the original.thus the output signal is an oscillating signal with frequency 43KHz. The output from this astable multivibrator circuit drives a piezo buzzer, producing ultra sound at regular repetitions.

4. We can calculate the value of resistors and capacitors to produce oscillation of 43Khz.by given formulae.
5. $F = \frac{1}{0.67 \times (R_1 + 2 \times R_2) \times C}$
6. In our case ,we have used :
7. R1=1K
8. R2=0.6K
9. C=0.01uF
10. So now,
11. $F = \frac{1}{0.67 \times (1 + 2 \times 0.6) \times 0.01 \times 10^{-6}} = 67.8 KHz.$
12. So , the output of this circuit ranges from 31Khz-100KHz.

Table 1: Output Frequency varying with Changing Resistance:

Obs. No.	Resistance (kΩ)	Frequency (kHz)
01	10	7.78
02	7.55	10.14
03	5.33	13.33
04	3.06	20.84
05	2.625	23.87
06	2.2	28
07	1.5	37.7
08	1.24	41.3
09	1.027	47.164

4. Software Simulation

We simulated our project in Proteus 8.0 software . We designed the circuit diagram in the schematic section we also designed PCB layout for our circuit .

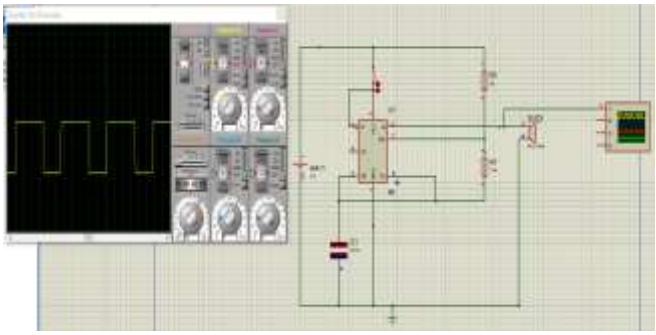


Figure 5: Circuit simulation in Proteus with output

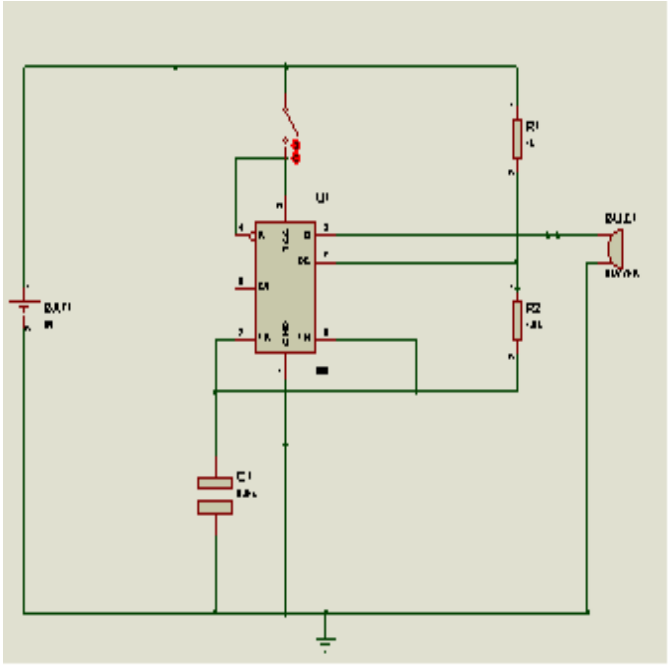


Figure 6: Schematic circuit drawing for PCB layout

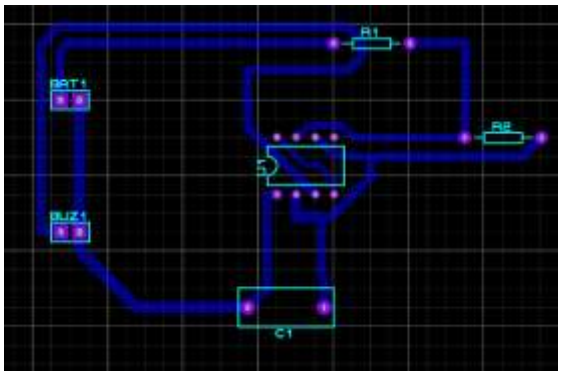


Figure 7: PCB layout of the simulated circuit

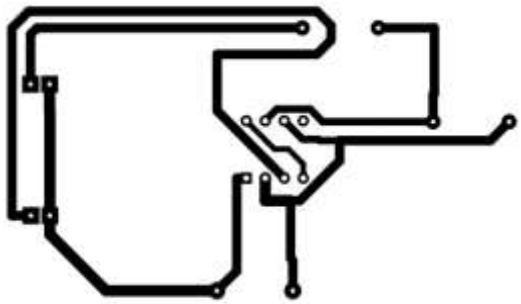


Figure 8: Final PCB layout for printing

5. Flow Diagram

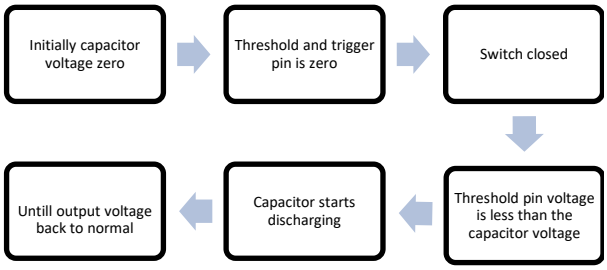


Figure 9: Flow diagram of the project

III. Cost analysis

Items	Quantity	Per unit cost (BDT)	Total cost(BDT)
Breadboard	1	110	110
1K resistor	2	1	2
1.5K resistor	1	1	1
555 IC Timer	1	15	15
9V battery	1	30	30
9V battery cap	1	10	10
0.01uF capacitor	1	1	1
10K potentiometer	1	15	15
Jumper wire	10	5	50
switch	1	10	10
Buzzer	1	20	20
Feric chloride	100gm	15	15
Glossy paper	1	60	60
CCB board	1	40	40
Female pin	1 row	10	10
		Total	389

Table 2 : Details pricelist of purchased components

This project is made keeping in mind that the cost should be as low as possible. This charging system is really cheaper than many other existing similar products .This system is really affordable.

IV. RESULT and APPLICATION

The Mosquito Repellent circuit has been worked at 44kHz frequency. While using the circuit as repellent, it produce no smoke or residue and can be used inside and outside. The batteries can be changed to eliminate mosquito without buying new products, and also the defective batteries are re-useable by recycling. That makes it an efficient and environment friendly.

This circuit can be used to modify so as to bring it into action for other insects by varying the voltage which subsequently changes the frequency of the circuit.

V. DRAWBACKS

Mosquito repellent circuit project has some drawbacks. The main difficulty in this project is that ultrasound travel at an angle of 45 degrees from the source.in case of any obstacles in the path, the signal gets reflected or diverted. It also requires a lot of frequency setting. Another disadvantage is that this circuit shows less effect on huge mosquito population.

VI. CONCLUSION and FUTURE SCOPE

In this paper, an effective Mosquito Repellent Circuit model for the mitigation of frequency disturbance in multiple areas is presented to be achieved the stability of interconnected power system. this circuit or project can be helpful in domestic area by keeping the mosquitos away using high frequency sound produced by the circuit. .Simulation of the proposed circuit design is shown and the hardware of the proposed system is implemented and tested in breadboard and printed circuit board (PCB). The system works properly but it has some drawbacks and this can be improved in future. we can put sensor and led lights in the circuit to detect mosquitos so that we will be able to know when there are mosquitoes around us. we can also use battery charger circuit so that it can also operate during blackout.

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