VELLORE INSTITUTE OF TECHNOLOGY

VELLORE

SCHOOL OF ELECTRONICS ENGINEERING

INTEGRATED CIRCUITS

PROJECT REPORT ON

“ELECTRIC MUSCLE STIMULATOR”

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Submitted to

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ABSTRACT

In our project we have built a muscle stimulator using astable multivibrator. This is a circuit that stimulates nerves of that part of your body where electrodes are attached. It is useful to relieve headache and muscular pain and revive frozen muscles that impair movement. Though it provides muscles stimulation and invigoration, it’s mainly an aid in removing cellulitis. The system comprises two units: muscular stimulator and timer. Fig. 1 shows the circuit of the muscular stimulator.

ACKNOWLEDGMENT

We express our deep sense of gratitude to our respected and learned guide Prof. Sasikumar K for his valuable guidance. We are thankful to him for the encouragement he has given us in completing the project.

We are also grateful to respected Prof. Sivacoumar R for permitting us to utilize all the necessary facilities of the institution. We are also thankful to all the other faculty members for their kind cooperation and help.

Lastly, we would like to express our deep appreciation to our classmates and to our parents for providing us moral support and encouragement.

DECLARATION

We hereby declare that the project entitled ‘Electric Muscle Stimulator’, written and submitted by Jasmine Ann Thattil, Mimangsha Sarma, Aakash Gnanavel and Vidwath Jagadeesh to VIT, Vellore, in partial fulfilment of requirements for J component in the subject Integrated Circuits, under the guidance of Prof. Sasikumar K, is our original work and inspiration drawn from the stimulation of motor neurons.

INTRODUCTION

The Electronic muscle uses very few basic components and is not only simple but also, very effective. The components used in the muscular stimulator circuit include

-A 10V battery

-IC 7555

-Transistors BC327

-Resistors (180k, 1.8k,2.2k,4.7k,100)

-Capacitors (100n,0.01µ)

-An LED or a buzzer

-A transformer

-Diode 1N4007

-Switch

When IC1 oscillates, transformer X1 is driven by the pulse frequencies generated to produce high voltage at its primary terminals. Separate electrodes are connected to each end of the primary winding of transformer X1. Diode 1N4007 (D1) protects transistor T2 against high-voltage pulses generated by the transformer.

Using potentiometer VR1 you can control the intensity of current sensing at the electrodes. The brightness level of LED1 indicates the amplitude of the pulses. If you want to increase the intensity level, replace the 1.8-kilo-ohm resistor with 5.6 kilo-ohms or higher value up to 10 kilo-ohms.

X1 is a small mains transformer with 220V primary to 12V, 100/150mA secondary. It must be reverse connected, i.e., connect the secondary winding to the collector of T2 and ground, and primary winding to the output electrodes. The output voltage is about 60V but the output current is so small that there is no threat of electric shock.

Electrodes are made of small, thin-gauge metallic plates measuring about 2.5×2.5 cm2 in size. Use flexible wires to solder electrodes and connect to the output of the device. Before attaching metal electrodes to the body, wipe them with a damp cloth. After attaching the electrodes to the body (with the help of elastic bands on Velcro straps), flip switch S1 to activate the circuit

and rotate the knob of intensity-Control preset VR1 very slowly until you feel a slight tingling sensation.

The components used in the timer circuit include:

-Resistors (10k,33k)

-Potentiometer (1M)

-Capacitors (220µ,0.47µ,0.01µ)

-IC NE555

-Piezo buzzer

-LED

-9V battery

-Switch

The timer circuit

It uses IC NE555 wired in monostable mode. Initially, when you press switch S2, the monostable triggers and its output goes high for 10 minutes. Thereafter, its output goes low to give a beep sound from the piezo buzzer and lights up the red LED (LED2) indicating that stimulation time is over.

CIRCUIT DIAGRAM:

Fig 1:Muscle Stimulator Circuit

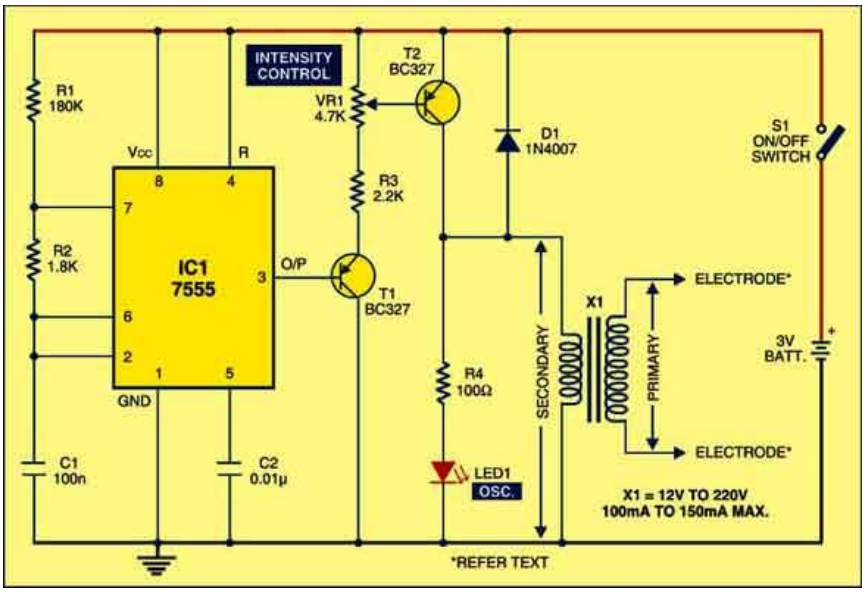
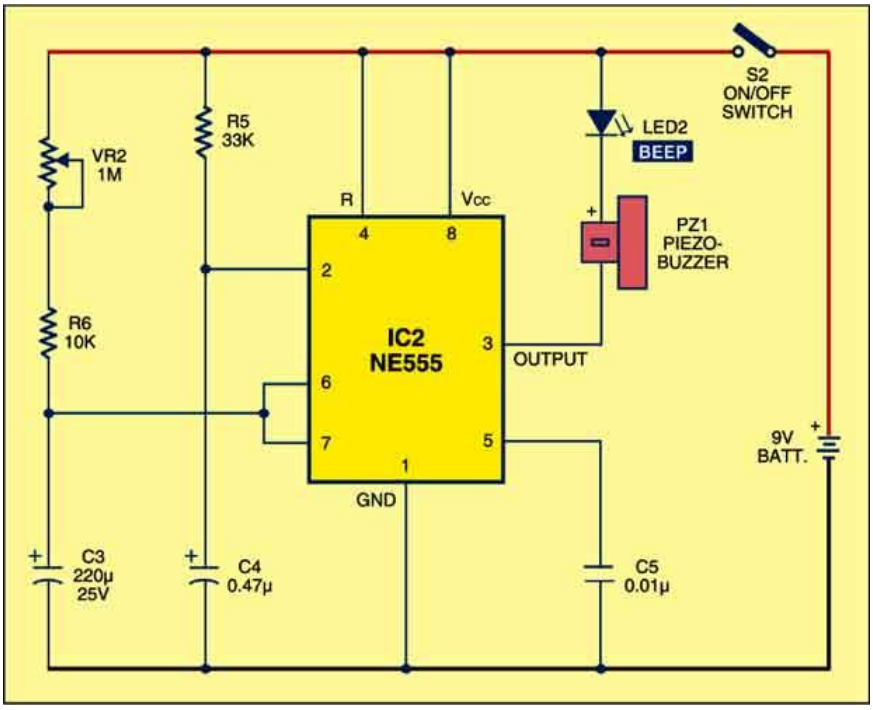


Fig 2:Timer Circuit



WORKING

The working of the circuit is quite simple. Assemble the timer with a separate switch and a 9V DC battery in the same cabinet as the stimulator. Tape the electrodes to the skin at opposite ends of the chosen muscle and rotate VR1 knob slowly until you sense light itching when the muscular stimulation circuit is powered on. At the same time, flip switch S2 to start the timer for counting the time. At the end of the timing cycle, the piezo buzzer beeps. Each session should last about 10 minutes.

OUTPUT

Electronic muscle stimulator reproduces the body's muscle contractions by applying electrical impulses to our motor nerves. Also, we benefit from the ability to target specific muscle groups. We can also try using it on athletes. The ability to stay warmed up without fatiguing can also help in other activities. Because electronic stimulation flexes your muscles without active assistance, we can train our muscles with less risk of overuse of our joints. The output is basically a shock that stimulates nerves to relieve a pain. We are also giving current and the potentiometer is used to adjust the current passing through the electrodes.

NOVELTY

This project has a lot of important applications which include:

Electronic muscle stimulation is a method that is often used in physical rehabilitation, pain management, and strength training. It uses an electrical current to create a beneficial effect on the treated tissue.

During therapy, electrodes are placed on the patient's skin sending tiny electrical pulses to various areas of the body to help curtail muscle spasms, reduce inflammation, and relieve pain. Other uses for electrical stimulation include helping to heal bone fractures, enhance medication delivery through the skin, heal skin incisions, and more.

Electrostimulation can also be used for athletic training for treating swelling and/or pain, particularly in the acute stage of the healing process when the injury is brand new and the swelling and pain inhibit function or progress. It treats the pain by stimulating the large nerve fibers, which often override smaller nerve fibers that are producing the pain.