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CLAP SWITCH CIRCUIT USING IC 4017

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Abstract— A clap switch circuit using IC 4017 is a simple and fun project that allows you to control a device, such as a light, by clapping your hands. The IC 4017 is a decade counter and can be used to sequence through its 10 outputs based on input pulses. A 555 timer through a transistor activates the LED and after some time, it will be turned OFF. When this circuit is connected to any electrical load, then it turns ON & OFF only through clap sound. This simple project is very useful as it doesn't need any exterior mechanism to perform the particular operations. This article discusses how to make a clap switch using 555 timers IC and it's working.

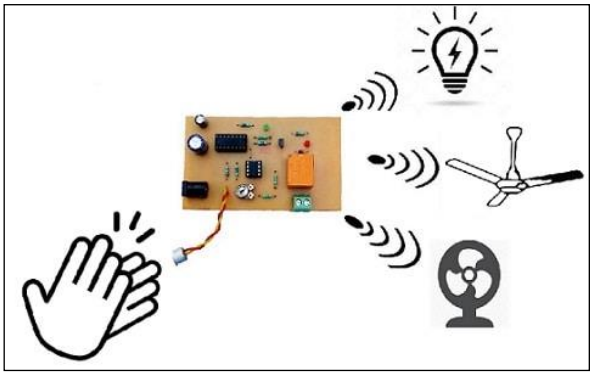
Keywords— **SWITCH CIRCUIT, IC 4017, 555 timer circuit, Hand claps**

I. INTRODUCTION

A circuited which operates through clap sound otherwise similar to that sound is called clap switch. This switch activates once or twice clapped & deactivates when again clapped once based on the design of the circuit. The fundamental concept of the clap switch is that the microphone used in this circuit receives the clap sound & generates a small signal to controls a lamp [1-4]. Generally, this switch is operated through sound. For instance, light, fan, TV can be controlled through clapping.

II. BLOCK DIAGRAM:-

The working of the clap switch is discussed through the block diagram of the clap switch. This block diagram includes an audio amplifier, bistable flip flop & circuit amplifier. In the above block diagram, an audio power amplifier is used to amplify audio signals with less power to a level appropriate for controlling loudspeakers.



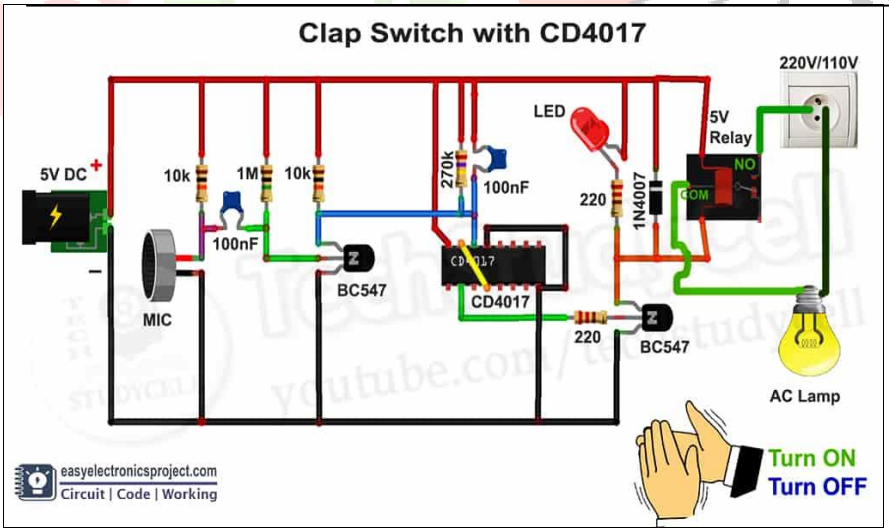
A flip-flop is a circuit that includes two stable conditions which are used to store state data, so it is described as sequential logic. The flip flop is a bistable multivibrator and usedas data storage elements. When employed in a finite-state machine (FSM), the next state & output mainly depend on its present input as well as the current state. So it can be used for pulse counting and also for coordinating input signals which are variably timed to some timing signal [5-8]. A bistable circuit includes two stable states wherever the output of this can be either logic 0 or 1 based on the received signals at the inputs. The simple bistable circuit includes two NAND gates.

III. REQUIRED COMPONENTS

1. CD4017 IC -1no
2. BC547 NPN transistors -2no
3. DC Condensor Mic -1no
4. 100nf (103) Capacitor -2no
5. 10k Resistors -2no
6. 270k Resistor -1no
7. 1M Resistor -1no
8. 220-ohm Resistors -2no
9. 1N4007 Diode -1no
10. LED 5mm 3volt -1no
11. 5v SPDT Relay
12. AC Lamp 220v/110v
13. 5v DC supply
14. Breadboard or PCB

IV. CLAP SWITCH CIRCUIT DIAGRAM

The circuit diagram of the clap switch using 555 timers IC is shown below. Here, a 555 timer is an essential component used in this circuit. Before going to know this circuit, we have to know what is 555 timer and its function in this circuit. As the name suggests, there are mainly three 5kΩ resistors that are connected internally to produce the reference voltage of two comparators [9-12]. This IC is a very popular, low cost & helpful exact timing device that can perform like either a timer to produce single pulses otherwise long time delays to generate a stabilized string waveforms by changing the duty cycles from 50-100%.



This is an extremely strong & stable IC with 8-pins. The operation of this IC can be done in three modes like Astable, Bistable & Monostable to generate different applications like delay timers, one-shot, LED, pulse generation, lamp flashers, tone generation, alarms, logic clocks, power supplies, converters, frequency division, etc.

i. **Microphone/ Sound Sensor Section:** The electric microphone or sound sensor captures the sound input (claps). The sound sensor output is connected to the trigger (pin 2) of the IC 555 timer.

ii. **IC 555 Timer Section:** IC 555 is configured as an astable multivibrator to generate continuous pulses. R1 and R2, along with C1, determine the frequency of the pulses. The output (pin 3) of the IC 555 is connected to the clock (pin 14) of the IC 4017.

iii. **IC 4017 Decade Counter Section:** IC 4017 is used as a decade counter with 10 outputs (Q0 to Q9). Each clap input triggers the IC 4017 to advance to the next output. Pin 3 (Q1) is connected to the base of the NPN transistor (BC547) through a resistor (R3). The collector of the transistor is connected to the coil side of the relay. The emitter is connected to the ground.

iv. **Relay** Section: The relay is used to control an external device (e.g., a light bulb). The normally open (NO) contacts of the relay can be used to connect or disconnect the device.

v. **LED Indicator:** An LED is connected to the first output (Q0) of the IC 4017 to indicate the active state.

V. Working Principle of Clap Switch Circuit

This circuit uses a sound-activated sensor as an input to detect the clap sound & generates the output by processing the input into the circuit. Once clap sound is provided to the Mic, then it gets Electrical Energy & turns ON LED. After some time, automatically the LED will be turned OFF. By changing the 100mF capacitor value, the activated LED timer can be modified because it is connected through a 555 timer. The main function of this is to generate a signal. The input of this circuit is clap or even any sound having the same pitch of clap sound. So this is also called a sound-activated switch. This circuit mainly uses transistors as the negative terminal of electric Mic is connected directly through the transistor. This circuit doesn't use any kind of switch to control the circuit.

Once the battery is connected to the circuit then the circuit will be activated. This circuit takes the input from the clap in the sound energy form. This circuit can be changed by employing a relay-like switch to control the circuit. Once the sound input is given to the circuit by clapping, then the sound signals can be changed to process them to the IC that generates the signal toward the light-emitting diode to activate the LED.

In the above circuit, we have to make sure if the negative terminal of the Condenser Mic is connected through the amplifier, then the circuit will heat up & may not work through different transistors models, etc. This circuit can also be used for different loads like fans, LAMP & other appliances. So there are many chances to adjust this circuit.

VI. Operation:

- Clap your hands near the microphone to generate a sound input.
- The sound sensor triggers the IC 555 timer, producing pulses.
- The pulses advance the IC 4017 outputs sequentially.
- The first output (Q0) lights up the LED, indicating that the circuit is active.
- The transistor and relay are triggered, connecting or disconnecting the external device.

So the operation can be happened in details:

- At first, the clap sound sensed by the condenser mic.
- The condenser mic converts the sound into an electric pulse.
- Then the electric pulse amplified by the BC547 transistor.
- After that, the electrical pulse fed to the CLK pin of CD4017 IC.
- For each high pulse at CLK pin the state of the PIN 2 changes.
- When the PIN 2 becomes HIGH, the second transistor turns ON.
- If the second transistor turns ON the Relay also turns ON.
- Now when the condenser sense the second clap sound, the next high pulse received at CLK PIN.
- The PIN 2 changed the state (becomes LOW), so the second transistor turns OFF.
- So the Relay turns OFF and the load connected with the relay also turns OFF.

VII. ADVANTAGES AND DISADVANTAGES

The **advantages of the clap switch** circuit include the following.

- The main benefit of clap switch is, we can control any electric load like light, a fan from any place in the room by clapping our hands.
- Energy-Efficient System
- Less Cost
- Circuit is Reliable
- High Accuracy
- Man Power is not Required

The **disadvantages of the clap switch circuit** include the following.

- The main drawback is that it is usually awkward to have to clap one's hands to control the load
- It normally looks simple in most cases to utilize a normal light switch.
- Unnecessary disturbances may occur while operating in buildings.

VIII. CONCLUSION:

THUS, THIS IS ALL ABOUT AN OVERVIEW OF CLAP SWITCH AND ITS WORKING WITH ADVANTAGES, DISADVANTAGES, AND APPLICATIONS. IN THE FUTURE, THIS CIRCUIT CAN BE ENHANCED BY ENHANCING THE EQUIPMENT RANGE USING A BETTER MIC. SO THIS CAN BE UTILIZED AS A REMOTE CONTROLLER. THIS CLAP SWITCH CIRCUIT IS A BASIC EXAMPLE, AND YOU MAY NEED TO ADJUST COMPONENT VALUES BASED ON YOUR SPECIFIC REQUIREMENTS AND THE CHARACTERISTICS OF THE SOUND SENSOR YOU ARE USING. ADDITIONALLY, YOU MAY WANT TO ADD A DELAY CIRCUIT TO PREVENT MULTIPLE TRIGGERS FROM A SINGLE CLAP. EXPERIMENTING AND ADJUSTING THE CIRCUIT PARAMETERS WILL HELP YOU OPTIMIZE ITS PERFORMANCE FOR YOUR APPLICATION.

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