

# Analysing Efficiency and Effectiveness of Clap Switch Mechanism Based on the NE 555 Clap Switch and Arduino Clap Switch

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## Abstract

In this paper the electronic circuit which is activated or turn on by the external sound is like claps or any other sound more than 2200Hz to 2800Hz frequency. When the remote point received the very first sound once the electronic circuit is switch on. If another one sound received by the system as a second input automatically system is going to off stage. The fundamental concept of the clap switch is microphone received the sound of the clap or any other sound, the circuit will be activated This kind of system has been helpful of the day to day activity example person can switch on and off the light any place in the room although lying in bed just clapping hands light is activated. This kind of switches mechanism were implemented with the different technology out of that we were analysed efficiency and effectiveness mechanism based on the NE 555 Clap Switch and Arduino Clap Switch. The NE 555 based clap switch is cost efficiency Arduino based Clap Switch is generating accuracy signals effective manner.

## Keywords

Clap switch, Arduino Mega2560, NE 555

## I. Introduction

The fundamental concept of a 'Clap Switch' it's in the title itself. The clap sounds were overseer if the switch were turns on stage until received the second input clap sound. When the second clap sound arrived to the circuit automatically goes to turn off stage. The fundamental design of the NE 555 based clap switch is a Microphone received the sound more than 25 dBA and convert the sound signal as the electrical energy then amplifier were enlarge the signal with the help of integrate circuit NE 555 timer to recognized the clap sound finally activate the circuit this is the general design of the clap switch. The Arduino based clap switch also carry out the same mechanism NE 555 is replaced with the Arduino ATmega2560 but the implementation part is easier than the NE 555 based clap switch.

The clap switch mechanism is helpful of the human daily activity like switch on/off the light in the home from any location. Switch on and off any peripherals inside the vehicles, activate the security cameras for the general purpose and the military purpose. Totally the advantages of clap switch circuit are Energy efficient system, normal cost and reliable circuit, High Accuracy and Complete elimination of manpower.

## 1. Related Work

Olokede, S.S were proposed clap activated switch device that will serve well in different phono-controlled applications, providing inexpensive key and at the same time flee from false triggering [1].

Jeneeth Subashini et al. designed sound activated system by used Triac(BT136). In this system the condenser microphone is fitted to monitor and generates AC signal. The AC signal which passes through DC blocking capacitor to base transistor (BC549). When TRIAC fires, it activates the Bulb glows [2].

Somangshu Bagchi et al. presented a method for clap switch with 555 timer chips, working of clocks and the relay. This type of device provides us with the working of NE555 timer chips and the relay. The relay is a type of switch which provides a conducting path only when current flows it. In

the 2nd timer triggers the relay a conducting path is established between terminals of the load and hence the device is turned on. The time interval between the claps is judged with the time constant established with the RC configuration which is  $T=1.1R7*C3$  [3].

## 2. Approach

- The microphone will pick the hand clap sound and converted as an electro signal.
- Human hand clap sound are normally within the 2200Hz to 2800Hz array.  
In the circuit the second stage amplifier will amplify the signal that has to be helpful the NE 555 timer to Identify the hand first clap sound.
- Switch will trigger the device and move to ON state.
- The second hand clap is Identify by the NE 555 timer within an interval then the switch will trigger the device and move to OFF state.

## II. Material and methodology

The implementation of the clap switch Mechanism has following stages showed in the Figure 1. Initial the received signal through the microphone is passed to the circuit then the system will be activated with the first input. Until received the second signal circuit is in the activated stage. After received second output to the circuit its goes to knock off stage.

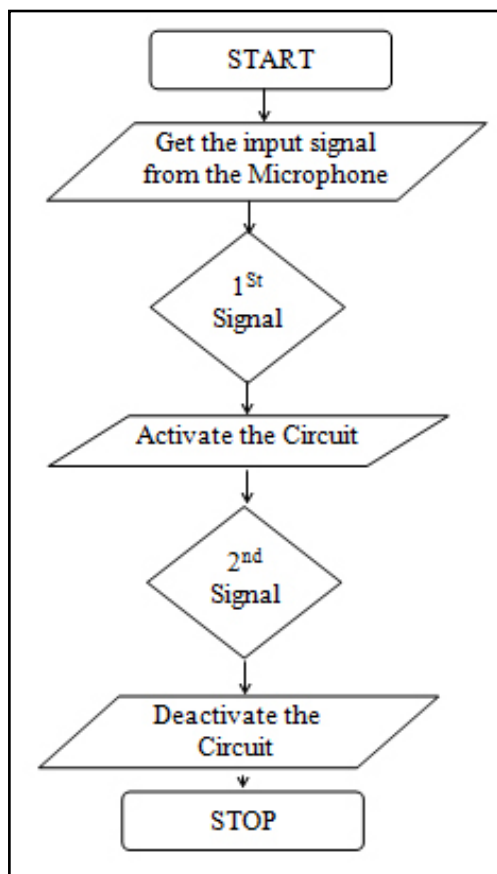


Fig. 1: The implementation flowchart.

**1. NE 555 Clap Switch Mechanism**

NE 555 clap switch module (Figure 2) was implemented by using the basic electronic components such as microphone, transistor, resistor, capacitor, semiconductor, diode and LED. An electronic microphone would pick up the input sound of the clap and that changes sound audio waves into an electrical energy wave which will be amplified by the following transistor.

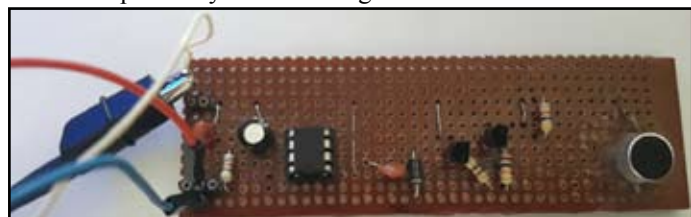


Fig. 2: NE 555 Based clap switch

There will be two transistors in a row and in between these transistors is a Bistable Multivibrator which will flip on or off. The transistor on the other side is connected to some electronic devices which want to control by the hand clap.

The device (LED) will switch on at the first clap and keep on up to the next clap sound. The relay would perform as the automatic switch. It is a sound based activated switch. Basically NE 555 clap switch mechanism require following showed in the Table 1.

Table. 1: Technical specification of the NE 555 based clap switch

Electronic Component	Specification
IC	NE555
Resistor (R1)	47k
Resistor (R2)	1k
Resistor (R3)	220k
Resistor (R4)	100k
Capacitor (C1)	10 uF
Transistor	NPN
Battery	9V
LED	
Microphone	

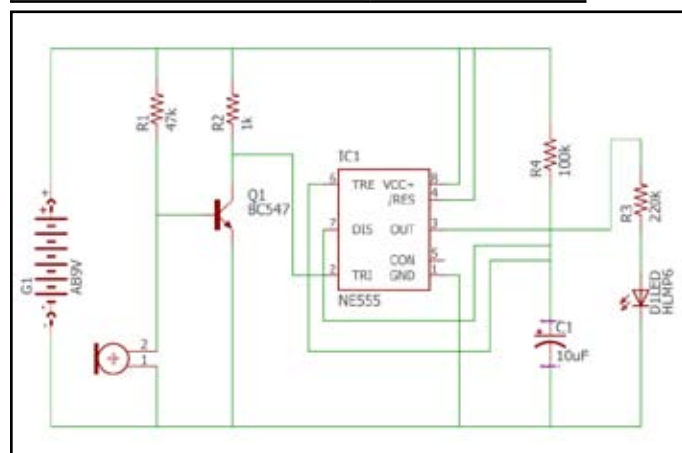


Fig. 3: NE 555 based clap switch circuit diagram.

NE 555 Timer IC is an essential electronic component of the clap switch. A simple circuit involving a single 8-bit micro-controller and some peripherals or a complex one involving system on chips (SoCs), 555 timer working is involved. These provide time delays, as an oscillator and as a flip-flop element among other applications.

Resistor device used in electrical current transmission to control the path of the current flowing to an electronic circuit by applying resistance. Resistors may be fixed resistors or variable resistors, both controlling the flow of current differently.

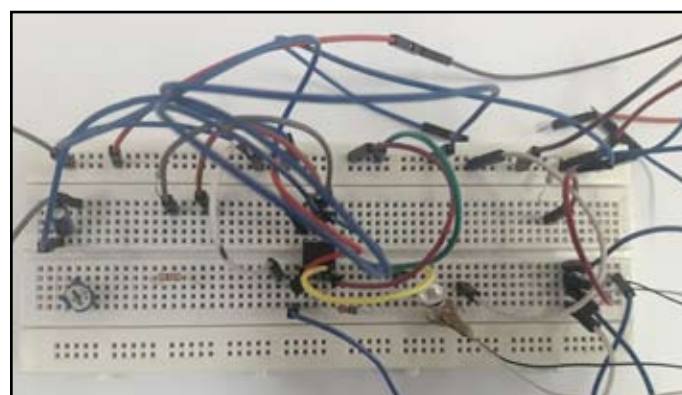


Fig. 3: NE 555 Based clap switch model

Capacitor is an electric circuit component used to keep charge impermanently, consisting in general of two metallic plates separated and insulated from each other by a dielectric. Also called condenser.

A semiconductor is a constituent, generally a solid organic

component or compound, that can conduct electricity under some circumstances but not others, making it a good medium for the control of electrical power.

Alternating current is electric current that reverses its direction many times a second at regular intervals, typically used in power supplies.

Microphone is the formally defined as an acoustic to electronic transducer or simply a sensor that can convert audio format signal to the electronic energy in this design of the clap switch microphone is used to detect the clap audio as the basic input to activate and deactivate the circuit.

Diode is an electronic device that controls current flow mainly to one direction.

Transistor is a small electronic device containing a semiconductor and having at least three electrical contacts, used in a circuit as an amplifier, detector, or switch.

LED is a semiconductor diode that converts applied voltage to light and is used in lamps and digital displays.

Transformer is an electrical device that used to transfer the electric energy from one circuit to another, especially a set of multiply wound, inductively coupled wire coils that affect such a transfer with a change in voltage, current, phase, or other electric characteristic.

Wire is a commonly flexible metal filament or rod made in many lengths and diameters, sometimes covered and often electrically insulated, used chiefly for structural support or to pass the electricity.

Relay is a device that responds to changes in voltage to voltage by activating switches or other devices in an electrical circuit.

Condenser microphone consisting of a capacitor with one plate fixed and the other forming the diaphragm moved by sound waves.

**2. Arduino based clap switch mechanism**

Arduino based Clap Switch Mechanism (Figure 5) circuit consuming the concept of Analog to Digital Conversion in Arduino ATmega2560. The Microphone and ATmega2560 to sense the sound and activate a response based on that basically turns ON or OFF the device.

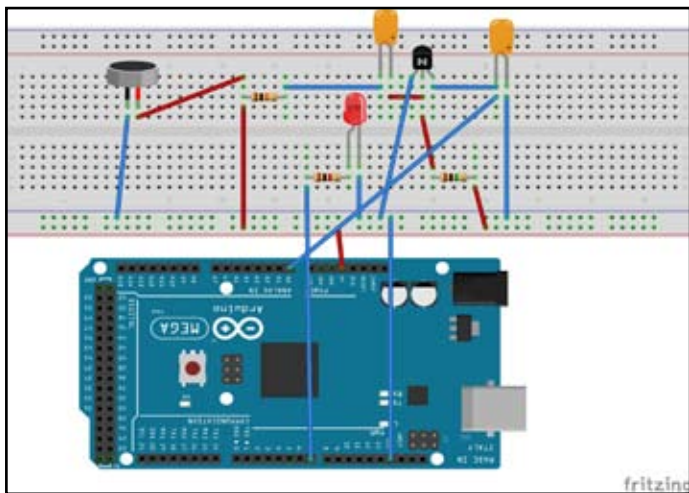


Fig. 5: Arduino based clap switch.

When the user clapped there have been highest signal at the microphone this signal is higher than normal signals, initially this signal is fed to the amplifier, throughout a High Pass Filter. Then the amplified signal is fed to Analog to Digital converter that

converts the high frequency voltage into variety. There will be a highest signal within the Analog to Digital converter reading of the ATmega2560. This highest signal finding can toggle a light-emitting diode on the circuit, on every interval clap[4].

Arduino Micro controller is a multipurpose tool that can be used for many electronic circuits implementation it's simply provide many function to a particular circuit. In the implementation of the clap switch module Arduino based mechanism were developed with the usage of the Arduino microcontroller. Technical specification of the system showed in the Table 2 [5, 6].

Table. 2: Technical specification of the Arduino clap switch

Electronic Components	Specification
Microcontroller	ATmega2560
Operating Voltage	5V
Input Voltage (Recommended)	7-12V
Input Voltage (Limited)	6-20V
Digital I/O Pins	54 (of which 15 provide Pulse Width Modulation output)
Analog Input Pins	16
DC Current per I/O Pin	20mA
DC Current for 3.3V Pin	50mA
Flash Memory	256 kb which 8 kb used by boot loader
SRAM	8 kb
EEPROM	8 KB
Clock Speed	16 MHz
LED Build in	13
Capacitors	100nF
Resistor (R1)	1M ohm
Resistor (R2)	1k ohm
Resistor (R3)	15k ohm
Digital Storage Oscilloscope	

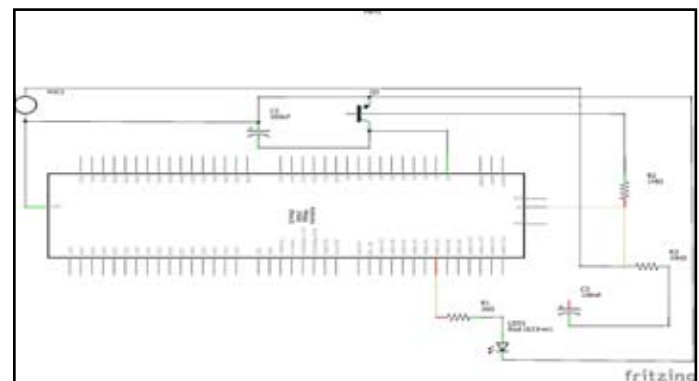


Fig. 6: Arduino based clap switch circuit diagram.

In this circuit (Figure 6) Arduino mega clap switch module filtration, amplification and analog to digital Conversion are the essential activity. Filtration means with the usage of R-C higher pass filter noises has been filter before amplification it has been easily design with the resistor and capacitor. A high pass filter allows signals of high frequency pass from input to output, in other words the input signal appears at the output if the frequency of signal is higher than the filter prescribed frequency. After this filter, current signal is fed to the transistor to the amplification. Amplification also essential in this circuit because the signal received by the microphone is very low frequency it can't identify by the Arduino mega and cannot fed to Arduino mega for Analog

to Digital Conversion because of that after filtration with the usage of transistor simply can amplifier signal voltage then is feed to Analog to Digital Conversion channel to converter the analog signal to digital formation[7].

```

analogRead(pin);
analogReference();
const int analogInPin = A0; // Analog input pin 0
int sensorValue = 0;
void setup()
{
  DDRD = 0xFF;
}
void loop()
{
  sensorValue = analogRead(analogInPin); //read Analog to
  Digital Conversion(ADC) value on channel 0
  if(sensorValue>60)
  {
    PORTD ^= (1<<7); //If there is a peak toggle the LED on and
    OFF on pin7.
    delay(250);
  }
}
    
```

To the Arduino based clap switch mechanism above mentation codes needs to be feed to the ATmega2560. In here analog pin 0 assigned as a input then reading the analog to digital conversion value on the channel 0 if there any peak toggle occur to the circuit LED automatically on and off connected with the pin 7.

### III. Result and discussion

To measure the efficiency of the both system acoustic measurements is very important. The Acoustic Measurements result is mostly depending on the internal components of the microphone such as springy clamping, ring capillary tube, gold-plated contact, disc spring, quartz isolation disc, backplate electrode and membrane. The efficiency of the system is determining the sound velocity also. The NE 555 based clap switch and Arduino based clap switch were analysis with acoustic and sound velocity measurements. Finally, Arduino based systems were providing more efficient than the NE 555 based clap switch circuit.

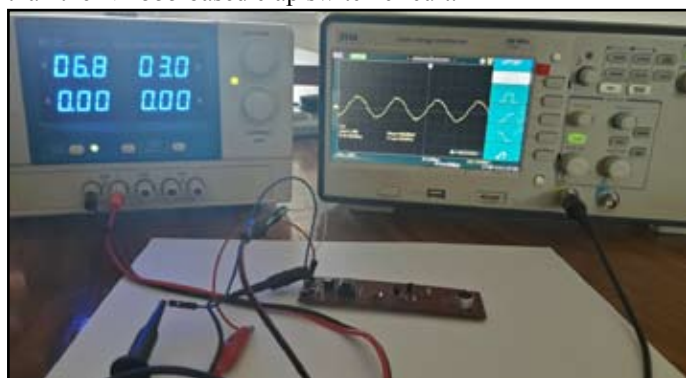


Fig. 7: Oscilloscope signal reading NE 555 based clap switch

Simply can measure the cost efficiency of the both system. The minimum cost is required to implement the NE 555 based clap switch but implementing Arduino based clap switch module is expensive. Arduino based clap switch module is working technical efficient manner. The power consuming of the both systems are similar. Maintenance of the system NE 555 based clap switch is

cheaper than the Arduino based system.

### IV. Conclusions

Assembling the circuit on the breadboard and having tested in multiple times with different test cases we could build our autonomous clapping switches with these two mechanism NE 555 clap switch and Arduino clap switch both were worked with efficiency and effectively.

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### Author's Profile



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