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Design and Construction of Electronic Clap Switch

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Abstract
This paper deals with the design and construction of an electronic clap switch circuit that can be used to switch ON/OFF electronic devices in the house, offices and industrial equipment. The system is designed in several units which are integrated to form the electronic clap switch circuit system. These various units are, the power supply unit, unit is achieved through the use of a 220v–24volts step-down transformer connected to a bridge rectifier model 2WWG whose output terminal is connected to a polarized capacitor rated 330µf and finally connected to a 12volt positive output voltage regulator with the number 7812 which is needed for this construction. The condenser converted the sound produced to electrical energy through a sensitive element in the condenser known as a diaphragm. The amplification unit was achieved by the use of an N-P-N transistor numbered BC547. Its function is to increase the electrical energy produced by the microphone which is known as the mic-level signal. The activation units were achieved by the use of a device known as a relay which triggered the electrical lamp. The activation is achieved when the first clap signal is generated to the microphone, the lamp or electric bulb is turned ON while that of the second clap turns OFF the light. The system (electronic clap switch circuit), is realized with some other components such as a Veroboard, looping wire, soldering lead and LED lamp or bulb used to indicate the status of the system.

Keywords: Electronic Clapp Switch, Transducer, Veroboard, LED, Thevinin's Theorem, Norton,s Rule

Introduction

Switches are the most integral part of our lives, looking at our homes and offices eventually many people use switches to turn on various electronic devices and applications. Light switches have been a long way thing since it was first invented by John Henry Holmes in 1884. These days, switches have gained popularity due to their features. Switches come in different or various designs and colours such as modular switches. The quick break technology initiated by Holmes is still found in also all light switches. After the invention of light switches, many came up with different designs, some were toggle switches invented by William which was invented in 1916. As a component of home system wiring or installation of light switching (electromechanical switch). The dimensions, designs and mode of operation have gradually changed over time. Electrical engineers define a switch as a device that breaks or makes electrical current flow in a different direction by connecting or severing its connection to one or more conductors. The contacts of a switch may be arranged in a variety of configurations, with one or more sets of contacts being toggled on and off by the same knob or actuator. A switch may be controlled by hand, or it can detect the pressure in a pipe, or the temperature in a thermostat, among other things. Toggle switches, rotary switches, mercury switches, push-button switches, reversing switches, relays, circuit breakers, and so on are only a few examples. Lighting control is a classic example of a situation where many switches on the same circuit are used for the sake of convenience (Bapat, 1992). But this work looks at that switch which can be used through the use of clap to trigger some appliance without body contact. Sound may now be used to activate software and hardware courtesy of the electronic clap switch, which can be thought of as an embedded system or electrical device.

The clap switch's most useful function is the little microphone it conceals. The term "Clap Switch" gives away the primary concept of this circuit. The clap acts as a check and balance for the embedded system, which is the on/off toggle. The vibrations from clapping your hands are picked up by an electronic microphone, also called a transducer or condenser, and transformed into an electrical wave, which is then amplified by a transistor. According to research (www.sazcomputeridq.com), 2012. The clap switch is around 65% efficient in early verification tests (Gorton,1999).

Today's technological progress may be traced back to the widespread implementation of electronic devices such as switches (semiconductor devices) in both the consumer and industrial sectors. (Mehta, 1998). Let's have a look at the many distinct ways that switch may be defined;

- The switch can be defined as a device or component which serves as a dam or barrel to the flow of electrons in a circuit.
- As a device which is used in the connection of two or more computers together to obtain a specific purpose or desire. (www.switches.com).

In this era of the modern world, switching circuits has become an essential part of our day-to-day life activity. Right from our electronic gadgets, mobile phones and other security systems. Also, look at our car's horns, and security sirens all this work is based on switching and switches are commonly used in electronics, instrumentation, electrical computer telecommunication etc. The electronic clap switches are very beneficial to our society in the sense that it does not require one to learn how to put or turn them on/off even the kid can easily use them to turn on home appliances, also use it to clear their sensation of vision by turning on light with the help of their hand clap. This clap-activated circuit can also be employed in our security-embedded system since it is an acoustic sound switch system. Putting this circuit at the side of an entrance door to an apartment and connecting it to an alarm system, will trigger the alarm at night if an unknown person(s) comes into an apartment without the awareness or notification of such person(s). The forceful opening of the door will propagate sound which will trigger the circuit making it convey a signal to the security alarm system due to its automating real life as a switching device

A clap switch is an example of a simple electrical switch built from inexpensive parts. The switch may activate any device or circuit that uses electricity by responding to the sound of a clap. An IC 4017 flip-flop is crucial to this task or undertaking. Most intriguing, however, is the condenser (mic), which can use a sound with the same pitch as a clap as an input source, transform that sound energy into electrical energy to activate the circuit, and produce an output of heat and light (Kuphaldt, 2012).

Materials and Methods

The circuit consists of three different sections are sensing unit (transducer) that receives the sound signal, the second stage or section is the amplifier unit which increases the signal gotten from the first stage known as (the mic level) the third unit is the trigger section (flip-flop). This unit triggers the relay to switch On/Off the lamp or load. Before placing the components on the phototype board (breadboard), all the components were tested to ensure the accuracy of this work with the use of a digital multimeter.

The theorems employed are:

- Thevenin’s theorem
- Kirchoff Rule
- Norton’s Theorem

According to Thevenin's theorem, every linear circuit may be reduced to a simpler equivalent circuit consisting of only one voltage source and a series resistance. V_{th} and R_{th} stand for the voltage and resistance of the Thevenin, respectively. You may write its equation as:

$$V_{th} = (R_{th} + R_L)I_L \quad (1)$$

Where

R_L and I_L are the Load resistance and Load current. Kirchhoff's rule is also applicable to solving complex circuits and this law is divided into two rules such as Nodal analysis and mesh analysis. The nodal analysis is called the voltage rules which states that the algebraic sum of voltage entering or leaving the loop is equal to zero.

Mathematically expressed as:

$$I_B R_B - V_{BE} - I_E R_E + V_{EE} = 0 \quad (2)$$

This implies that $V_{EE} = I_B R_B + V_{BE} + I_E R_E$ (3)

Emitter voltage w.r.t. ground is given as

$$V_E = -V_{EE} + I_E R_E \quad (4)$$

$Base\ voltage\ w$.r.t. ground is expressed as

$$V_B = V_E + V_{BE} \quad (5)$$

$collector\ voltage\ w$.r.t ground is given as

$$V_C = V_{CC} - I_C R_C \quad (6)$$

Subtracting equ. 1.4 from equ. 1.5

This implies that $V_C - V_E = (V_{CC} - I_C R_C) - (-V_{EE} + I_C R_E)$

Let $V_C - V_E = V_{CE}$

This implies that $V_{CE} = (V_{CC} - V_{EE}) - I_C(R_C + R_E)$ (7)

An electronic clap switch is a device used to turn on/off an electric bulb or other electronic device. In this work, a small condenser EM9767 capacitor microphone was used as a transducer, converting non-electrical signal to electrical signal, a 12-volt power supply, a bridge rectifier (2W10G) which carried out the conversion of AC to pulsating DC connected to a 330μf 35V polarized capacitor that filter the pulsating DC, BC547 transistor for signal amplification, IC 4017 which operate as a multi-vibrator (flip-flop circuit), this regulate the cube relay to trigger the lamp On and Off state. At default, the voltage across the mic, V_m is set to be less than the turn-ON voltage (0.7v). Because of the high input (i/p) impedance of R_1, T_1 and R_M (Mic resistance) are considered in series.

Hence

$$V_m = \left(\frac{R_m}{R_m + R_1}\right) V_{cc} \quad (8)$$

The available mic has a resistance of ≤ 0.99v, then from equation 8

V_m ⇒ mic voltage

R_m ⇒ Mic resistance

R_1 ⇒ The first unknown resistor

From equation 8 the input data are;

V_{cc} = V_{CE}

V_m = 0.99volt

R_m = 1Ω

R_1 = ?, V_{cc} = 12volts

Substituting these values into equation (8)

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$\Rightarrow 0.99 = \left(\frac{1}{1+R_1}\right) 12$

$0.99 = \left(\frac{1 \times 12}{1+R_1}\right)$

$(1 + R_1)0.99 = 12$

$1 + R_1 = \frac{12}{0.99}$

$R_1 = \frac{12}{0.99} - 1$

$R_1 = 12.12 - 1$

$R_1 = 11.12\ K\Omega$

The closest standard values are 10K Ω & 33 K Ω but 10 K Ω was used in this construction.

For transistor 1 (T_1)

$V_{CE1} = V_{CC} - I_C R_C$ (9)

In the absence of signal, $I_C = 0$

It implies that,

$V_{CE} = V_{CC}$ (10)

$R_C = \frac{V_{CC}}{I_C}$ (11)

In this design, I_C is desired to be 0.12A

This implies that

$R_C = ?$

$V_{CC} = 12$ volts

$I_C = 0.12A$

Equation 4 is given as

$R_C = \frac{12}{0.12} = 100\Omega$

R_C represent R_3 in the circuit. This value of R_3 was used in this circuit.

The duration of a pulse (Time constant) is determined by R_3 and C_2

$T = 1.1 \times R_2 \times C_2$ (12)

This time (T) is set to be around some seconds, with a value of C_2 chosen as $0.47\mu f$, R_2 can be obtained.

From equation 12

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$1 = 1.1 \times 0.47 \times R_2$

$R_2 = \frac{1}{1.1 \times 0.47}$

$R_2 = \frac{1}{0.517}$

$R_2 = 1.93\ K\Omega$. The value of R_2 used was 1KΩ.

The value of R_2 was used while the capacitor value $0.4747\mu f$ that is being used in the circuit (clap switch) was recommended in the IC datasheet.

The following are the materials used for the construction of this work:

- Digital Multimeter
- Soldering iron and soldering lead
- Cutter
- Sucker
- Plier
- Microphone
- Integrated Circuit (IC) flip-flop 4017
- Capacitor C_1 = 330µf
- Capacitor C_2 = 0.47µf
- Bridge rectifier (2W10G)
- Resistor R_1 = 10kΩ
- Resistor R_2 = 1kΩ
- Resistor R_3 = 100kΩ
- Resistor R_4 = 1kΩ
- Voltage regulator = 12V
- Transistor = BC547
- Transformer = 220 – 24V
- Relay
- Vero Board
- Looping Wire
- Heat sink

The diagram below shows the block diagram of the switch

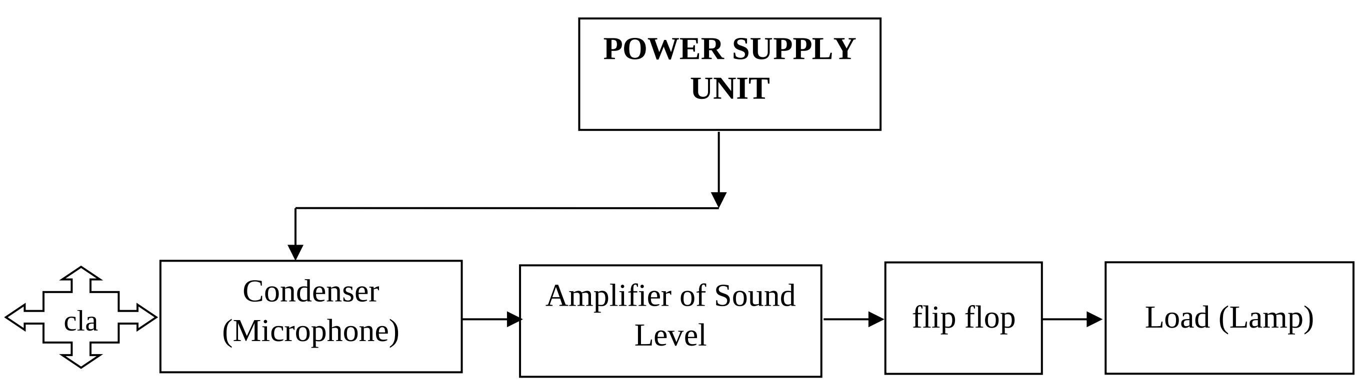

Figure 1.0: Block diagram of clap switch circuit

Power Supply System or Unit.

The full-wave bridge rectifier is coupled to a step-down transformer with inputs of 220 volts and 500 milliamperes (mA) and produces an output of 24 volts. The bridge rectifier is responsible for converting the alternating current to direct current. The four diodes of a bridge rectifier are linked in series. The (2W10G) produces a 12V DC voltage that is pulsing as it is converted. To get rid of the pulsing DC, a filter capacitor designated C1 is utilized. The following equation describes the capacitor's capacitance. The positive 12V fixed voltage regulator (Lm7812) controls DC voltage to minimize ripple and pulse.

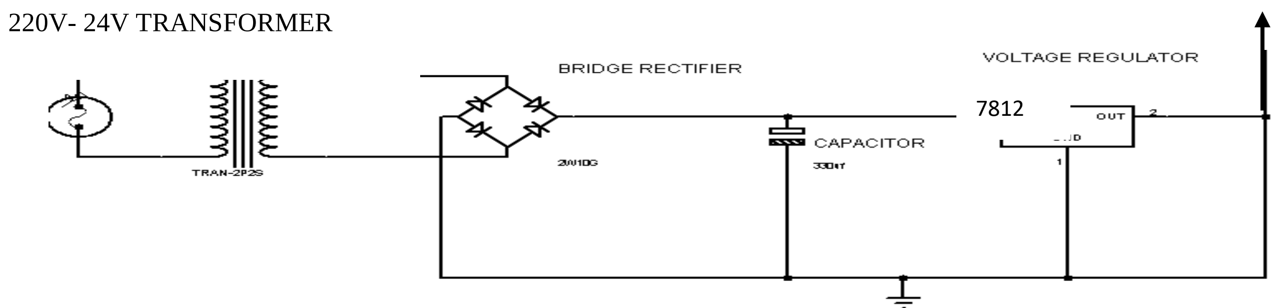

Fig 2.0 The Block Diagram of the Power Supply, the filter and the Voltage Regulator.

This unit consists of a step-down transformer, a rectifier, a filtering capacitor and a voltage regulator for an output. The output supplies pow

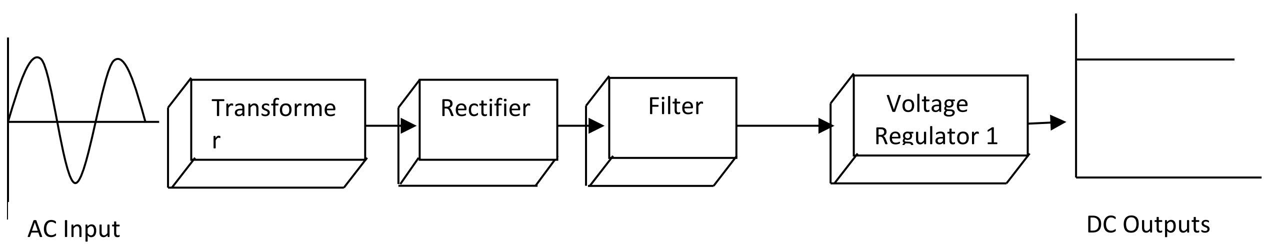

Fig 3.0 : Block Diagram of the DC Power Supply with Expected waveforms

Transformer

The transformer is a passive component that provides power transfer from one electrical system to another. This project is responsible for the transformation of the alternating current (ac) mains voltage (and current) from 220V to 24V. Since electronic components usually make use of low voltages, isolation from the mains is required. The transformer does both the transformation and isolation. Figure 4.0 shows the schematic symbol of a single-phase transformer (with fuse); the type used in this design.

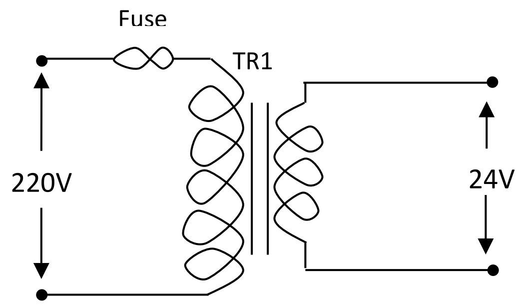

Figure 4.0: Schematic Symbol of a Single-Phase Transformer

Transformers are rated in voltage and current. To avoid overheating and thus consider tolerance, a 220V/24V, 500mA transformer was used.

Rectification

As shown in the block diagram, the transformer output is fed to the rectifier to convert the 24V AC signal to a DC signal with some ripple content at the output. The bridge rectifier is the type used in this work. The four diodes D1 to D4 are actually in an IC package with part number 2W10G. The schematic symbol with associated input and output voltage waveforms is shown in Figure 5.0 below.

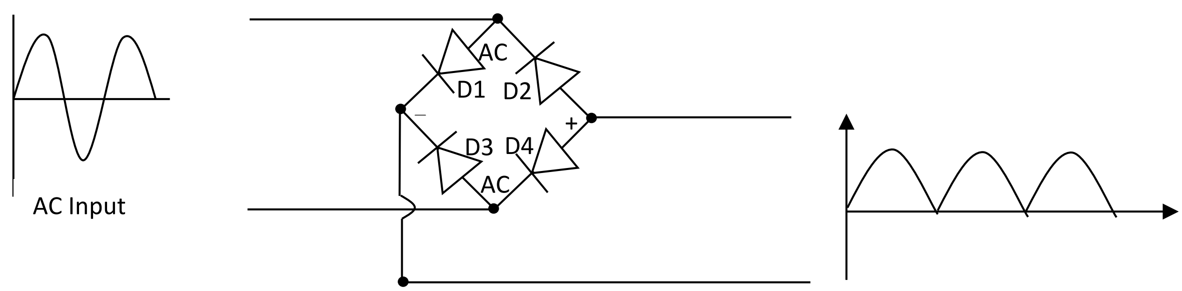

Figure 5.0 Bridge Rectifier Symbol with Input and Output Waveforms

The important parameters of the rectifier are the Peak Inverse Voltage (PIV) and maximum current (I_{max}) it can withstand. It is necessary that:

$$\mathrm{PIV} \geq 4 \times V_{SM} \tag{13}$$

Where,

V_{SM} → Maximum value of transformer secondary voltage given as:

$$V_{SM} = \sqrt{2} \times Vs \tag{14}$$

Where, Vs → RMS value of transformer secondary voltage which is 24V

$$\therefore \mathrm{PIV} \geq 4 \times \sqrt{2} \times 24 \mathrm{PIV} \geq 135.7\mathrm{V}$$

Filter

The current output of the power supply is determined by a filtering or smoothing electrolytic capacitor which also removes the ripple associated with the output of the rectifier. This capacitor ensures that a smooth and near-perfect dc voltage is obtained. The property utilized here is the ability of a capacitor to oppose the rate of voltage change. The filtering stage of the power supply is shown in Figure 6.0.

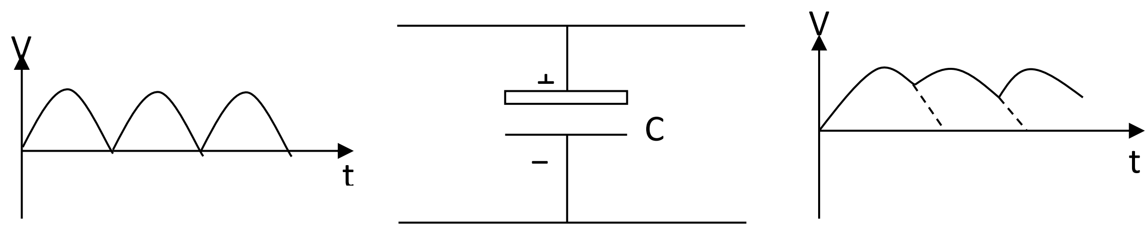

Figure 6.0: Filtering Action of an Electrolytic Capacitor

Capacitors are usually rated by the maximum capacitance and voltage they can withstand. Different approaches may be used to obtain these parameters but the method employed in this design is presented below.

From equation (14):

$$V_{SM} = \sqrt{2} \times 24$$
$$V_{SM} = 33.94 \text{ V}$$

If capacitor input voltage (rectifier output) is represented by V_{IP}, then:

$$V_{IP} = V_{SM} - 2V_D \quad (15)$$

Where,

V_D = diode drop = 0.7 V

$\therefore V_{IP} = 33.94 - 2 \times 0.7 = 22.35\text{V}$

Recall that for full wave rectification;

$$\gamma = \frac{I_{DC}}{4\sqrt{3} \times f \times C \times V_{IP}} \quad (16)$$

Where,

γ = ripple factor

f = ripple frequency in Hz

C = minimum capacitance in μF

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I_{DC} = desired power supply current in Amp.

Equation 16 can be rearranged to give:

$$C = \frac{I_{DC}}{4\sqrt{3}\times f\times \gamma\times V_{IP}} \quad (17)$$

Assuming the ripple is to be kept below 3%, then substituting f = 50Hz, V_{IP} =22.35V and I_{DC} = 300mA into equation 17:

$$C = \frac{300 \times 10^{-3}}{4\sqrt{3} \times 50 \times 0.03 \times 22.35}$$

$$C = 1.58\mu F$$

The working voltage, V_W of a filter capacitor is given as:

$$V_W = 1.41V_{SM} \quad (18)$$

$$= 1.41 \times 22.35$$

$$= 31.5\ V$$

To apply the concept of Component De-rating (tolerance), C is chosen as 330µF/35V.

Voltage Regulator

A voltage regulator is a circuit element that provides a constant DC output despite fluctuations in mains voltage, changes in load current, ambient temperature or even temperature of components. One voltage regulators were used in this design. The part numbers are 7812 to provide 12V DC output, respectively. The 12V output is used to engage the switching circuits.

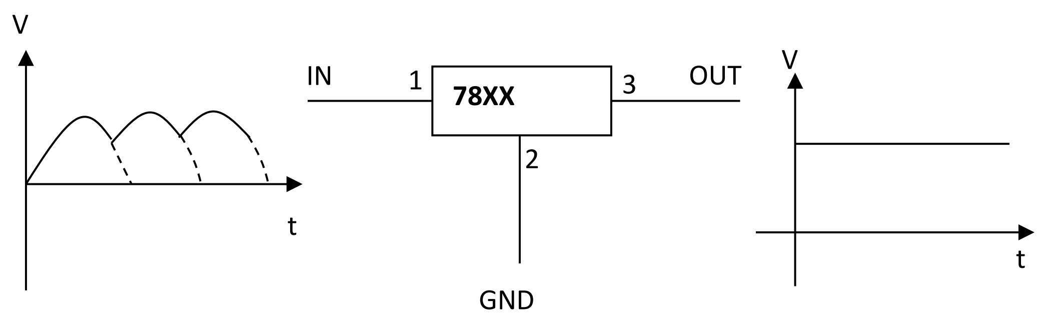

Figure 7.0: Schematic Symbol of an IC Regulator with ideal input and output waveforms

$V_{peak} = 1.4\times V_{rms} - 2.4$ (19)

Where V_{rms} is the output value of the transformer

V_{rms}= 24V (20)

V_{peak}= 1.4 × 24 – 2.4 (21)

V_{peak} = 33.6 – 2.4

V_{peak} = 31.2V (22)

To obtain voltage difference denoted by V_d

Vd = V_{peak} – V_{drop} (23)

V_{drop} = V_{out} + 2V (24)

V_d = V_{peak} – (V_{out} + 2V) (25)

V_d = 31.2 – (12+2)

V_d = 17.2V (26)

The capacitance of the capacitor C_1 is given below

$$C_1 = \frac{1}{120 \times V_d} \quad (27)$$

$$C_1 = \frac{1}{120 \times 17.2} = 0.48\mu f \quad (28)$$

By applying the concept of component de-rating (tolerance), the capacitor chosen in the clap switch circuit as shown in Figure below is $0.47\mu f$ a close range to the value obtained above.

2.4 V = voltage drop in the full wave bridge rectifier

2V = voltage drop of the regulator.

The calculation above shows that the 24 volts obtained from the step-down transformer has a voltage drop of 2.4 volts which implies that, the voltage from the bridge rectifier is 21.6 volts. At the point of the capacitor, it dropped by 2 volts.

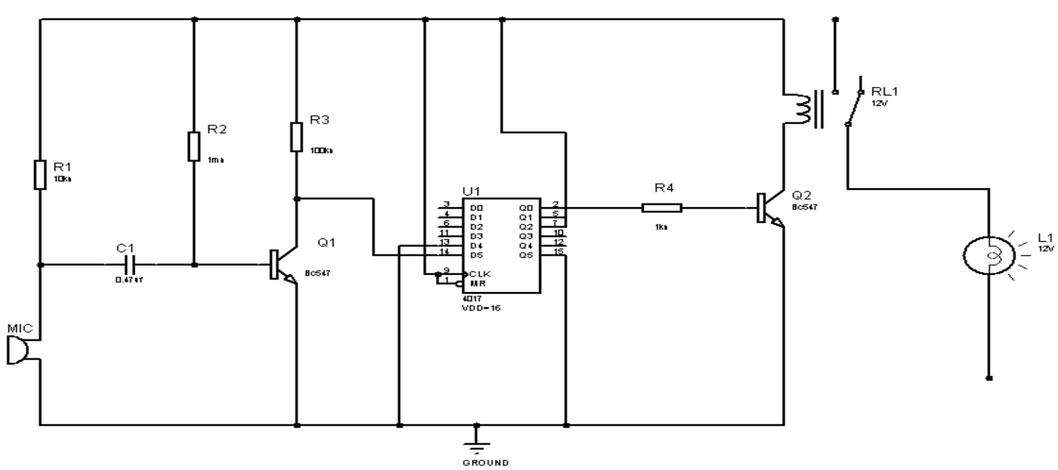

Fig 8.0 Clapp Switch Circuit.

Microphone Condenser

The main component used to execute this work "electronic clap switch" is the condenser or mic. This device is used as a transducer or a sound sensor. This condenser or mic converts the sound energy into electrical energy that in turn used to trigger the flip-flop.

Condenser Diaphragm

This is a very thin element or a membrane that moves or vibrates due to the reaction of an external sound pressure. The diaphragm is the key component of a transducer which carries out the converting of acoustic energy into electrical energy, for other semiconductor materials to carry out their function.

The microphone diaphragms are made up of durable and flexible materials which can maintain their strength when subjected to great tension and extreme thinness, which also include conductive material to be able to generate an electric mic-level signal. The British called the diaphragm a "capacitor" and according to physics, a capacitor is an essential two parallel metal plates nearby. The closer they are, the higher their capacitance. The condenser capsule is similarly constructed in this manner as stated above. The most common material used as the membrane is that of a gold-sputtered mylar. This very material is of high working efficiency, based on its electrical property or conductive, and its mic level current can be relied on.

Clap Switch Concept

An electronic clap switch circuit device used to turn On/Off an electric bulb or lamp operates on the principles of acoustic sound or wave. It consists of a condenser (mic) which senses the clap or sound, and a transistor connected to the positive terminal (+Ve) to increase the signal produced by the condenser to be able to trigger the integrated circuit (IC) 4017. The concept behind this work is such that the condenser is protruded or placed on top, or side of the matrix box to be able to sense the clap, and why other components are being placed on the Vero board inside the matrix box. Some other electronic or semiconductor materials are connected either in series or parallel with the condenser, transistor, resistors and capacitor, which are components which also contribute to the actuation of the circuit by acting as a filter, coupling, and frequency. Electromechanical devices were commonplace before the advent of modern electronics. Subsystems, especially those with greater switch strength, are common in complex systems (Lojek, 2007).

Mathematical Design for Mic or Condenser

From the manufacturing datasheet, the electric condenser has the following specifications:

Rated Voltage	= 6V
Operating Voltage	= 1 to 10V
S/N	= 55dB

Deducing for the microphone-biasing resistance (R) is given by:

$$R_1 = \frac{(12 - 6)\text{V}}{6mA}$$

$$R_1 = {}^{6}/_{6} = 1\text{K}\Omega.$$

Design Calculation for Transistor Switch using BC 547

Supply Voltage = 12V

The resistor is driven by the load resistance of 470Ω

$$I_{BC} = \frac{V_{supply}}{Load\ Resistance} \tag{29}$$

$$I_{BC} = \frac{12}{470}$$

$$I_{BC} = 25\text{mA}.$$

Looking at the amplification of this transistor at maximum linear output along the DC load line. The inactive or a state of rest known as the quiescent can be obtained as half of the supply voltage.

$V_{CE} = {}^{12}/_{2}$ - (30)

V_{CE} = 6volts

Calculation for Transistor

It is possible to achieve signal amplification using this electrical component or device (Mehta & Roht, 2009). A transistor's primary function here is to accept a signal from the input transducer (the microphone), which it then uses to regulate the power supply and generate the current necessary to ignite the load.
Design Cal. For transistor switch.
Transistor = BC 547
Voltage Supply = 12volts
Load Resistance = 1kΩ
Load Current =?

$I = {}^{V}/_{R}$ (31)

$I = {}^{12}/_{1000}$ = 12mA.

From Ohm's law V = IR (32)
Where V_S = source voltage
V_{CE} = Collector-Emitter Saturation voltage
R = the summation of emitter resistance and collector resistance.
$R = R_C + R_E$
I_C = Collector current
$I_C = V_s - V_{CE} \times \; R_C + R_E$
I_C = 2mA, V_s = 12 volt, V_{CE} = 0.3 volt
$V = I(R_C + R_E)$
2mA = 12 -0.3 × $R_C + R_E$

Making $R_C + R_E$ the subject of formula,

$R_C + R_E = {}^{V}/_{I}$ (33)

$R_C + R_E = \frac{12 - 0.3}{2mA}$

$R = \frac{12 - 0.3}{2 \times 10^{-3}}$

= 5.85kΩ

When the Circuit is off-state

The power of the BC 547 transistor at the off state is given by power = $V_D \times I_C$

At this point, the transistor is said to be in off state because no signal has been generated. Thus the Transistor Voltage Input (V_{IN}) is less than 0.3V because its base current is zero.

I_C=0.

Substituting these values in equation 3.26 above

Transistor Power = V_D × 0 = 0

P = 0

Looking at it ON states mathematically,

$P = V_C \times I_C$ since $V_{CE} \cong 0$

$P \cong 0$ so, it implies that the power is very small.

Applying Kirchroff's Voltage Law to The Base Loop

This implies that:

$$V_{BB} - I_B R_B - V_{BE} = 0 \quad (34)$$

Where V_{BB} is the base voltage of the transistor,

I_B - Base current of the transistor.

R_B - Resistance Value of the Resistor connected to the transistor base.

V_{BE} - Base Emitter voltage of the transistor.

Inputting the values into the above equation (33)

$= V_{BB} = 12V$, $I_B = ?$ $R_B = 1m\Omega$, $V_{BE} = 0.7V$

$V_{BB} - V_{BE} = I_B R_B$

Making I_B the subject of the formula,

$$I_B = \frac{V_{BB} - V_{BE}}{R_B}$$

$$I_B = \frac{12V - 0.7V}{1 \times 10^6} = \frac{11.3}{1 \times 10^6}$$

Applying Thevenin Theorem to the amplification unit of the circuit,

It implies that

$$R_0 = \frac{R_1 R_2}{R_1 + R_2} + R_3 \quad (35)$$

Where R_0 = Thevenin Resistance

$$R_0 = \frac{10K\Omega \times 1K\Omega}{10k\Omega + 1k\Omega} + 100K\Omega$$

$$R_0 = \frac{10K\Omega}{11K\Omega} + 100K\Omega$$

$$R_0 = 100.9k\Omega$$

To obtain the voltage across the amplification units using Thevenin's theorem.

It implies that = E_0 = Voltage across Resistor (R_3)

Hence,

$$E_0 = \frac{R_3}{R_1 + R_2} \times V \quad (36)$$

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$E_0 = \frac{1}{10+100} \times 12$

$E_0 = \frac{1}{110} \times 12$

$E_0 = 0.009 \times 12 = 0.10V$

This implies that the voltage across the circuit is greater than the knee voltage.

Results

Proteus Application Design of Electronic Clap Switch

The design of the electronics claps switch circuit was done by the use of the proteus software application after some calculation was done and a prototype was carried out using a breadboard. An output was confirmed to actuate properly before the various components/ materials listed in the previous section is fully purchased.

Amplification stage

The amplification stage consists of the transistor mounted on the heat sink which is connected with the capacitor and resistors, using connecting wire and soldering lead to hold them firm or fixed. The BC547 is an NPN transistor, in which the collector and emitter are left open (reverse-biased) and the base pin is grounded and closed (forward-biased). The base pin has a gain value of 118. This value shows or indicates that the amplification capacity of this BC547 transistor is preferably OK for this clap switch circuit, this output is obtained through the use of a multimeter.

Purpose of Using BC547 Transistor

The BC547 is a general-purpose BJTNPN transistor which is mostly used in electronics, besides that, it can as well be used in commercial circuits. The main purpose of BC547 for this work is due to its ability to have a very good DC gain and a low noise in signal amplification (small audio) and also a good switch to a small load on a very low input voltage and current.

Power supply system

This pictorial view in Fig shows the connection of the power supply component which comprises 220V input and 24 volts output connected to a bridge rectifier, that converts the AC signal to a pursuing D.C. connected in parallel to the polarized capacitor and 12-volt regulator which sends out this expected voltage to the system for proper actuation. These components are connected with a flexible wire, soldered with lead, using a soldering iron to make the joint properly fixed. The output is obtained using the multimeter to read its value. At this point, the transformer is not connected to it yet.

Off-State Electronic Clap Switch

At this stage, the transistor is in an OFF state because there is not enough voltage, that is the voltage is lesser than the (0.7v) base-emitter voltage to turn it ON. This simply means that there is no sound produced near the condenser or microphone to produce some electrical signal which will break down the barrier voltage to trigger the flip-flop circuit. At this point, the LED lamp remains OFF.

On State

This figure demonstrates or shows the trigger state of the circuit by the application of hand clap (sound) to the condenser or microphone which converts the sound produced to an electrical signal or electrical energy and it will raise or increase the potential at the base of the transistor. At this point, it will turn the transistor ON. As soon as this is done, the potential or energy barrier becomes low and this will trigger pin 2 and there will be an output. This will create a high and positive clock pulse, it will be applied to the flip-flop which will turn ON the lamp (bulb). This SET state of the flip-flop is going to remain as it is until the next clock pulse is produced to turn OFF the lamp or electrical bulb.

Conclusion

A clap switch circuit that employed a condenser as a transducer to transform an acoustic signal into an electrical one has been designed and constructed. Due to their similarity in low-frequency sound and pulse wave features, hand claps at a distance of two to three meters from the circuit embedded in an insulated case that acts as a mechanical protection, triggered the clap switch. The resultant gadget is practical in that it is both reliable and reasonably priced. Some component values were modified to ensure the work was accurate and would perform as intended.

Recommendations

1. The electronic clap switch circuit should be mass-produced to reduce the use of manual switches. The electronic clap switch can also be modified to perform works such as powering heavy equipment in the office and industries at large.
2. For further improvement or modification, the electronic clap switch circuit can be achieved by the use of some programmable IC to operate at a specific frequency of sound signal in terms of security.

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