IJCSE International Journal of Computer Sciences and Engineering Open Access
Review Paper Volume-4, Special Issue-6, Aug 2016 E-ISSN: 2347-2693

Automatic Control of Electrical Loads Using Human Claps

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Available online at: www.ijcseonline.org

Received: Jun/28/2016 Revised: July/16/2016 Accepted: July/26/2016 Published: Aug/12/2016

***Abstract*—** In our day to day modern life, time is a very vital factor for us. In order to save time as much as possible, the concept of clap switch has been introduced in this work. For example, when a person walks from one room to another, it becomes very tiresome and time consuming to move on to the switch board and switch the lights on and off. Therefore an automated human clap controlled system has been implemented and the detailed development of the circuit has been documented in this paper. The method has been implemented by using a sound acquiring device and sound to electrical energy conversion method and the circuit switching connections in order to control the switching on and off of electrical loads.

***Keywords*—** clap; relay; multivibrator; capacitor.

I. INTRODUCTION

The basic idea of the human clap oriented electrical load switch is that it can switch on and off any electrical circuits by detecting sounds of claps. A sound sensitive circuit has been implemented in order to acquire and convert the sound signal into electrical signal.

The entire block diagram of the circuit is shown in Fig. 1.

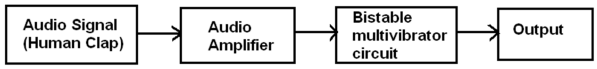
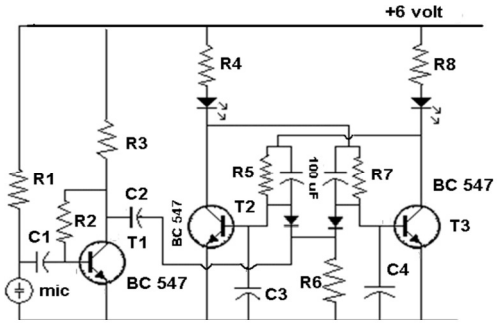


Fig. 1. Block Diagram of Project

The total circuit diagram of the implemented circuit is shown in Fig. 2.



The numeric values for the circuit components shown in Fig. 2. are shown below.

All resistances are of 1/4th watt and carbon resistance. Resistance R1, R5, R6 and R7 are around 30-40KΩ. R2 is a very high resistance of the order of mega ohm. R3 is manipulated inside 10 KΩ with a potentiometer. R4 is a low resistance of the order of 250-300Ω. Capacitor C1 is a charge storing capacitor with magnitude of 10µF. C2 is a coupling capacitor to drive the bistable multivibrator in order to swap or switch on/off. The value of C2=10µF, C5 =C6 =100µF each.Transistor T1, T2 nd T3 are used to be an npn BC547 transistor. BC547is used because it has high current amplification factor [2]. For demonstration of the circuit operation, two LEDs are used as Electrical loads in this system.

III. WORKING PRINCIPLE

The sound emitted from human clapping the sound is fed to the microphone which converts the sound energy into mechanical vibrations within the microphone. Being a capacitive type microphone, the diaphragm of the microphone forms one of the plates of a capacitor. The other plate is the back plate, which is close to and parallel to the diaphragm.

The already established fundamental relation between the charge stored across the plates of the capacitor and the voltage generated across the plates are shown in Eqn. 1.

$$Q = C * V$$

$$V=Q/C \qquad 1.$$

Since one of the plates of the capacitor in the capacitor microphone is a diaphragm, which moves in response to sound, the distance between the two plates also varies in response to that generated sound. The capacitance changes

and thus voltage across the plates also changes. This variation voltage is produced by the microphone in response to sound.

This voltage signal is first fed into a capacitor (C1), which stores the voltage developed in the microphone as stored charge. Then this signal is fed into an electronic amplifier circuit, which consists of a transistor BC 547 (T1) which amplifies the low level signal. Further, this signal is fed into the bistable multivibrator circuit, via the coupling capacitor 10 μF (C2).

For demonstration purpose, two LEDs are here alternatively switched on and off by human claps. The bistable multivibrator circuit consists of two cross connected transistor that conducts alternately, and hence the lights glow alternately. This can set to one of the two possible states, and it will stay in that state until another human clap sound signal is acquired. When one transistor conducts, its collector is near ground, and a resistor from this collector feeds the base of the other. Since this resistor (R5) senses ground at the collector end of the transistor, the base at the other is off. Since the transistor is off, its collector is near around the +6 volt potential and the resistor 47 kΩ connects from this to the base of the other transistor. Since this resistor senses high voltage, it supplies the base of the first transistor remained on. This will ensure that the first transistor remains on. Thus these states of the collectors of the transistors are bistable. Hence, the two LEDs which are connected to collectors of the two paired transistors are switch on and off alternately in accordance to the states of the transistor, by the sound of the human claps.

IV. AUTOMATIC SWITCHING OF THE COMMON HOUSEHOLD APPLIANCES USING ELECTROMAGNETIC RELAY CIRCUITS

In a Single Pole Double Throw (SPDT) relay, there are two connectivity points from another point 'Common'. The connectivity points are normally closed (NC) and the other is normally opened (NO). After the relay is energized, the connections between common and NC gets broken while connection between common and NO gets established. Hence the main power supply gets switched on or off, accordingly. A diode is connected in parallel to the electromagnetic relay, to prevent any induced back emf, when the relay gets switched off.

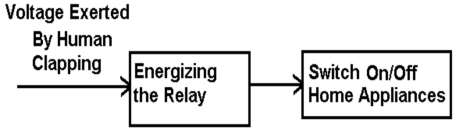


Fig. 3. Block Diagram of the Relay Circuit

The power supply line to any household electric appliances will be designed through the connections of "Common" and "Normally Connected" path. Whenever the relay gets energized, the contact will be disconnected and the appliance will be switched off. As the charge of the hand-clapped voltage is getting stored by the capacitor, the switched off condition of the appliance will remained unaltered until the person himself goes to switch on the appliance manually. The same logic can be applicable to turn on any electric home appliance. In this regards, the power supply line of the home appliance must be connected between the connections of "Common" and "Normally Opened" path. Whenever voltage due to hand clapping arrives, the relay gets energized and the connection between "Common" and "Normally Connected" path gets closed and the appliance will get turn on. The current to energize the relay must meet the proper ratings. In order to achieve this, a current amplification stage is implemented before the current from hand clapped voltage is fed to the relay. The current amplification is achieved by an npn BC 547 transistor connecting in common emitter mode. In this mode, input current is given at the forward biased base whereas the amplified output current is obtained at the collector end. The current amplification factor of BC547 is very high which servs the purpose of high current amplification. The amplified current is then transferref to relay to energize the circuit. The total circuit is shown in block diagram form in Fig. 4.

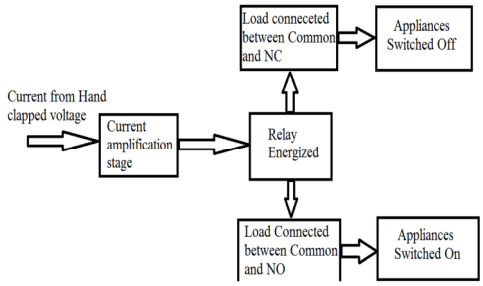


Fig. 4. Block diagram of the relay operation

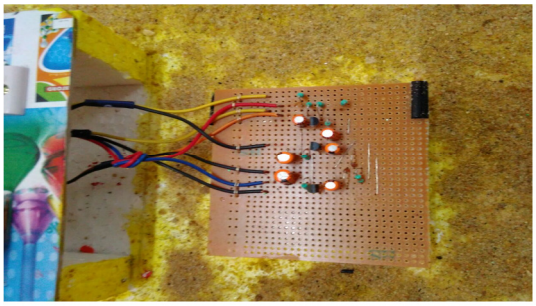


Fig. 5. Snapshot of this implemented Circuit

V. PROBABLE REAL LIFE IMPLEMENTATIONS OF THIS WORK

This automated human clap controlled electric load system can be implemented for various applications. Any necessity of switching on or off the household loads without getting closer to the switch board can be fulfilled by this work. The possible applications are mentioned below.

1) The household lights and fans can be automatically switched on and off by clapping while the person is laying in his bed.

2) Any possible accidents that may be caused by faulty electrical switch boards can be avoided by this non contacting method of electrical load control.

3) Chances of accidents due to the wet hand contacts can be minimized by this method.

4) This method also guarantees automatic non contact switching to the common home appliances like geyser, induction heater, chimney etc.

5) This circuit is very suitable for aged, dwarf and disabled persons.

VI. ADVANTAGES OF THIS CIRCUIT SYSTEM

1. The circuit is very cost-effective.

2. The circuit is easy to implement.

3. This circuit can be used for switching on and off any type of home appliances.

4. The circuit consumes very low power.

ACKNOWLEDGMENT

The authors want to thank Electronics and Instrumentation department, Narula Institute of Technology to provide the facilities and support to the work.

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