Task 1 Report

Team Number: 16

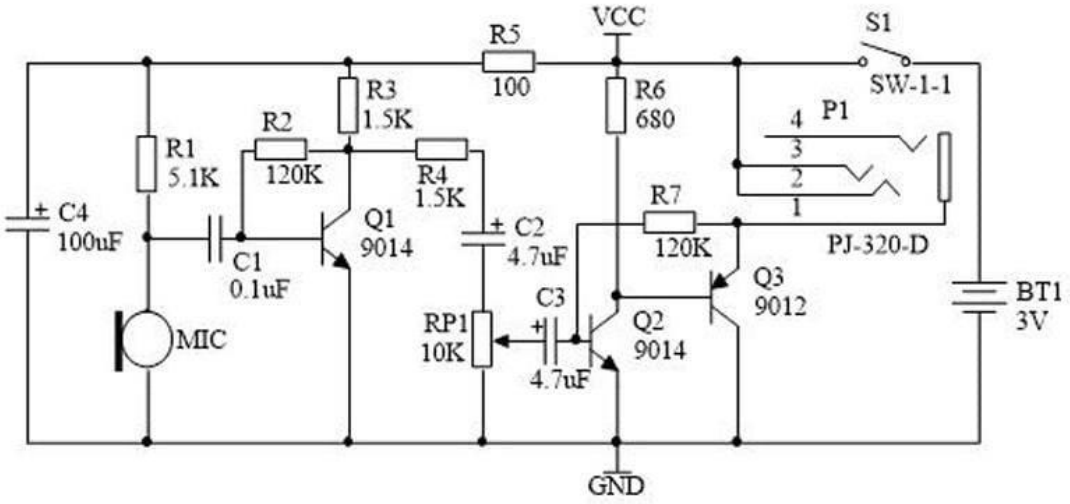
Team Members:

- Youssef Ahmad Shawky
- Muhammad Sami Ahmad
- Muhammad Sayed Abdel-Salam
- Hager Samir Ibrahim

Objective:

A circuit that works as a hearing aid for people who have hearing problems by amplifying the output from the headset which it’s signal is coming from the mic.

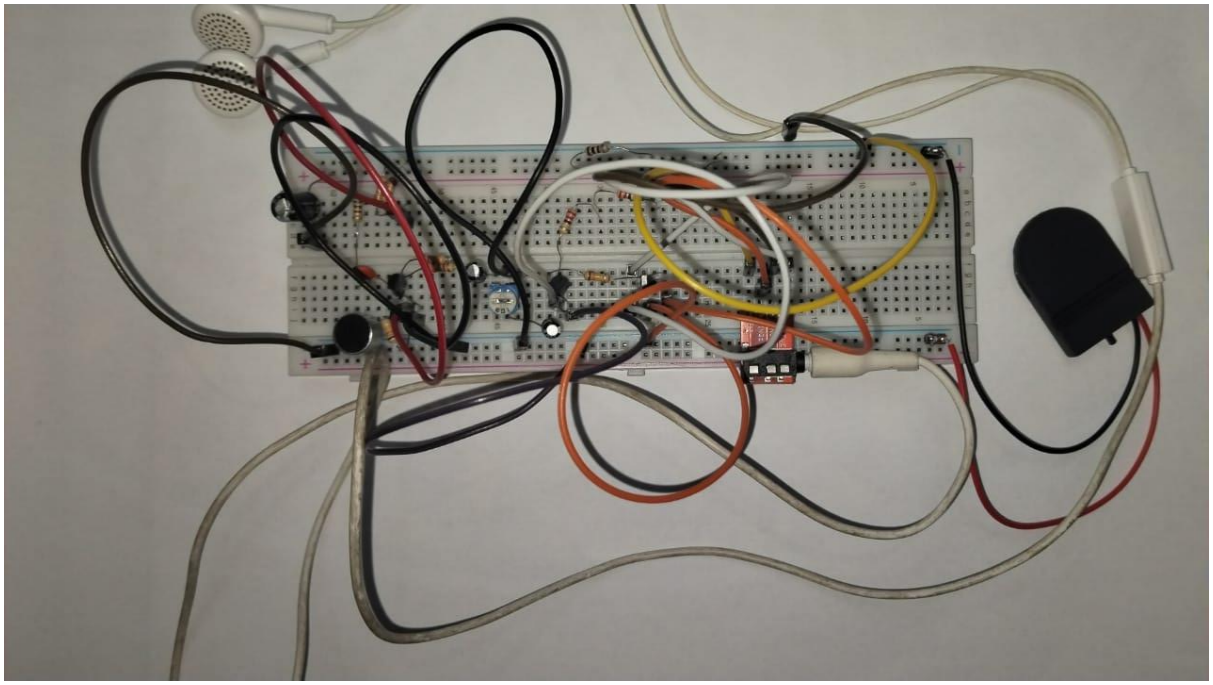
Circuit Schematic:



Circuit Components:

- 5.1KΩ Resistor (R1)
- 120KΩ Resistor (R2, R7)
- 1.5KΩ Resistor (R3, R4)
- 680Ω Resistor (R6)
- 100Ω Resistor (R5)
- S9014 transistor TO-92 (Q1, Q2)
- S9012 transistor TO-92 (Q3)
- 0.1μF ceramic capacitor (104) (C1)
- 4.7μF electrolytic capacitor (C2, C3)
- 100μF electrolytic capacitor (C4)
- Blue and white potentiometer horizontal 10KQ (103) (RP1)
- PJ-320-D headphone jack (P1)
- Electric microphone (MIC)
- CR2032 battery shrapnel (BT1)
- Circuit Breadboard

Circuit in real life:



How our project works:

- Our Project makes use of BJT transistors of high current gain reaches to 300, all of them work in the active region of operation. Such transistors are connected in the form of two stages cascaded transistor amplifiers.

- The first stage consists of a single common-emitter NPN transistor (Q_1), where the output of such stage is carried over to the consecutive stage without losing much of it, due to the managed voltage division, which is achieved by the potentiometer (10KΩ) and the Resistor R_4 (1.5KΩ).

- While, the second stage consists of sziklai transistor, which is a configuration of 2 transistors, this configuration provides an extremely high current gain reached to 9300 (Q_2 & Q_3 collectively) according to the following equation: ($\beta_{Total} = \beta_{Q2} \times \beta_{Q3} + \beta_{Q2}$).In such stage the majority of the amplification is done, where there is a huge voltage difference between the base of (Q_2) and the emitter of (Q_3) due to the existence of a Resistor of 120kΩ.

- Each transistor amplifier is coupled at its input and output to block the DC component which comes due to the biasing battery.

- A filter is connected in parallel to the input source (electret microphone, they can have an extremely wide frequency response from 10Hz to 30kHz) to reject the undesirable frequencies.

- The volume of sound is controlled by the potentiometer inserted before the second stage of amplification, by controlling the AC input voltage.

Challenges:

1. In the beginning, we couldn't obtain the hearing aid kit (a kit with a built-in circuit having the same components in the above schematic except for the resistors and the mic) that we were going to purchase online, so we had to get every single component in the kit ourselves and connect them together on the breadboard following the above schematic.
2. We couldn't find the exact values for the resistors (R3, R4, R6), so we used two 3KΩ resistors and placed them parallel to each other to obtain the value 1.5KΩ for resistors (R3, R4), as for the (R6) resistor we used three 220Ω resistors in series to obtain a value of 660Ω which is very close the 680Ω.
3. Dealing with the audio jack connections in the schematic was really the hardest part we had to watch a number of videos to fully grab the concept and make it work.