Under the supervision of:

Dr. Said Emam

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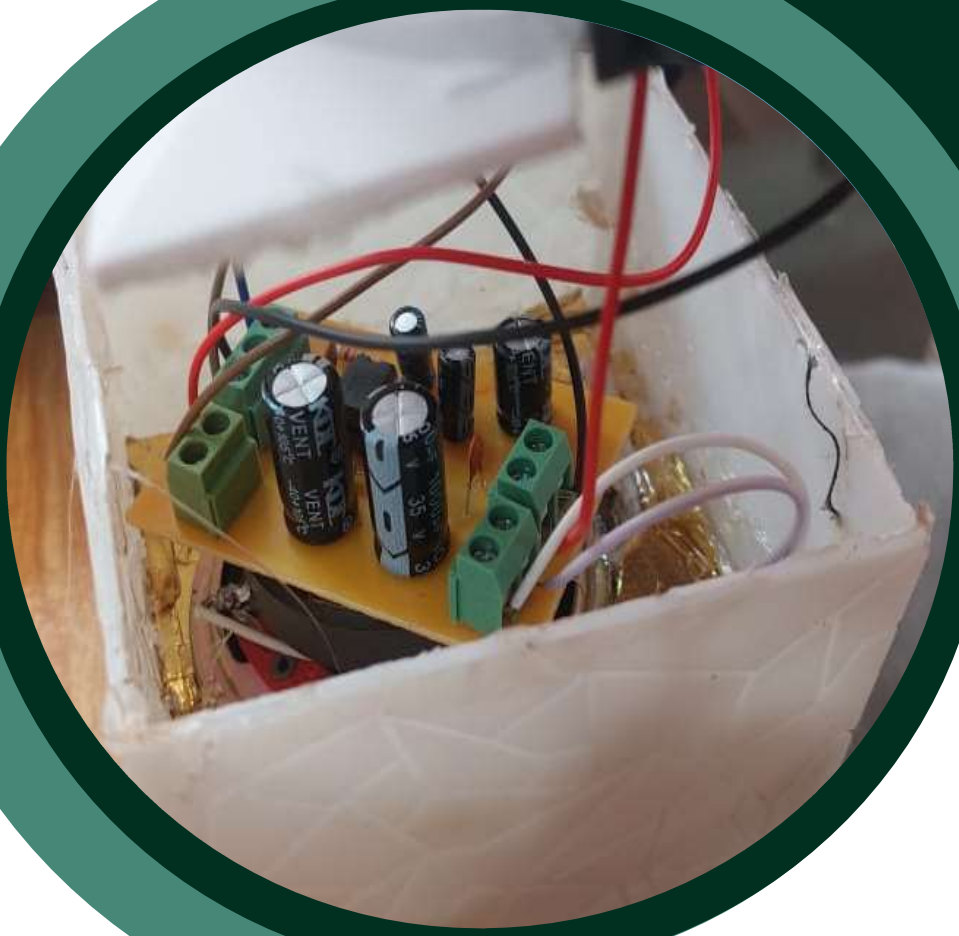

Audio Amplifier Project Report

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Introduction

The goal of audio amplifiers is to reproduce input audio signals at sound-producing output elements, with desired volume and power levels faithfully, efficiently, and at low distortion.

There are various usages of audio amplifiers. Some of them are listed as follows

- In the sound systems, these amplifiers are most widely used.
- In various instruments that relate to music, these amplifiers are installed.

How did we select the design?

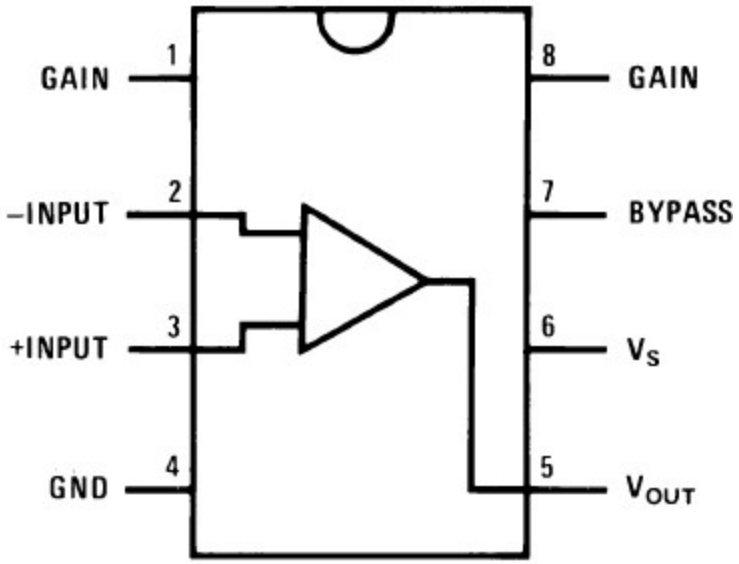
we searched for a basic design at first to understand how the circuit operates, then we found it was not good and needed more improvements, so we troubleshooted the circuit issues and fixed it, then we tried the design on proteus until it gave us a decent result.

After making sure it works using the simulation, we implemented the design using the breadboard to test it after it worked successfully, we made the PCB design and installed our components on it. as we'll discuss later.

Firstly, to understand how the circuits works in details, we need first to understand how the most important component works, which is the IC LM386N-1 (Operational amplifier).

The LM386 Audio Amplifier IC which is an audio power amplifier integrated circuit designed for use in low voltage consumer applications. Mostly its used as an amplifier in computer speakers and small portable stereos.

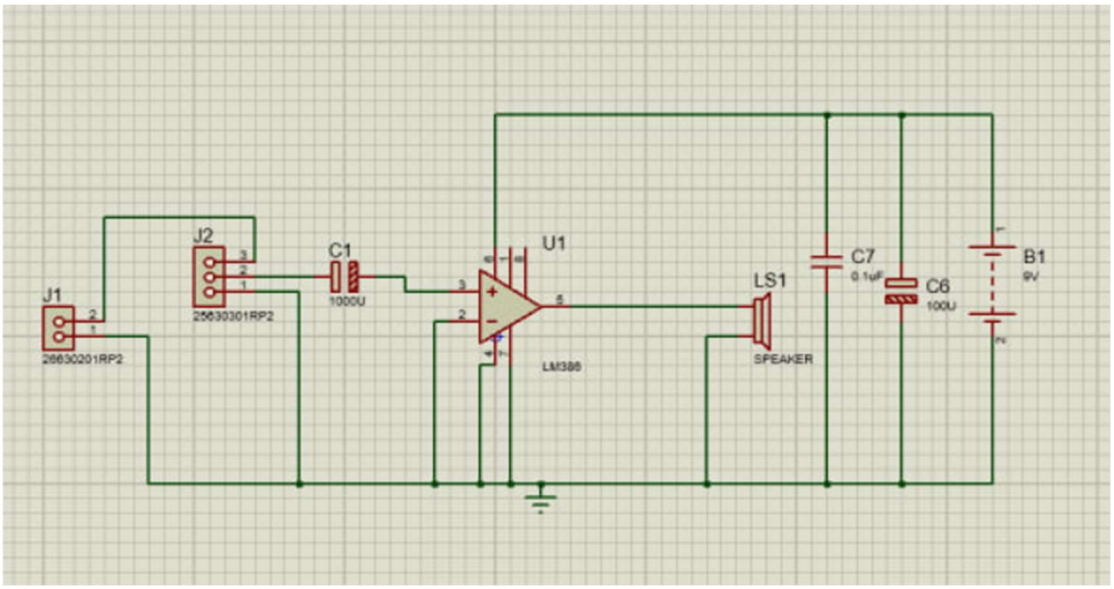
The LM386 IC has total of 8 pins, each of them has its own function.



- Pin 1 and 8 represents the gain control terminal of the amplifier, we can adjust the gain placing a resistor and capacitor or a capacitor alone between the two terminals.
- Pin 2(-ve input inverting) and 3(+ve input noninverting) represents the sound input terminals, where we input the audio, we want to amplify.
- Pin 4 is the terminal connected to the ground.
- Pin 5 represents the output of the amplifier where the amplified sound imputed comes out.

- Pin 6 receives the needed positive Dc voltage to amplify the signal imputed
- Pin 7 sets the path for decoupling and a capacitor must be connected between Pin 7 and Ground

Initial design



We take the audio input using aux cable and connect it to the aux connector, the connector is then connected to the terminals of the potentiometer which is used in controlling the amount of voltage going to the operational amplifier.

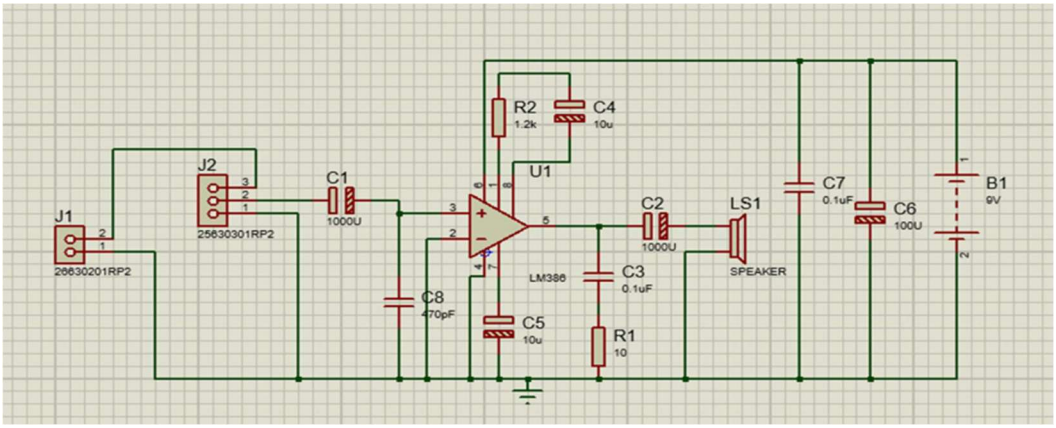
we connect the output pin of the potentiometer to a 1000µf electrolytic capacitor to filter the DC offset coming from the audio signals and then connect it to pin number 3 (IC input pin), The IC gives the output out at pin number 5 (IC output pin).

But how will the IC operate? we used a 9V battery as referenced to operate the OP AMP in the Q-point to make faithful amplification and plugged it into pin 6 (IC Power supply pin). So, the amplifier receives the necessary power to amplify the signal.

Two capacitors are connected to the positive terminal of the DC source (100µf electrolytic capacitor and 0.1µf ceramic capacitor) which are used to decouple the power supply, the 100µf capacitor will filter low frequency noise while the 0.1µf will filter the high frequency noise. (BYPASS capacitors)

Then we connected the output to the speaker and found out there was some noise, so *we troubleshooted the problem as we will discuss:*

Final design



We found that the output audio was not high enough as the output of the IC by default is only 20 times bigger than the input and there was some noise radio interference picked up by audio input wires.

We searched how to solve these problems and we used the op amp datasheet to help us.

So, we connected a 10µf electrolytic capacitor in series with a 1.2K ohm resistor to raise the gain of the IC from 20 to 200 times (between pin 1 and 8) and we used a 470pf ceramic capacitor connected to pin 3 to solve the radio interference problem.

To enhance the output signal more, we connected a bypass 0.1µf ceramic capacitor to pin 7 to decouple the audio input signal and to reduce the noise.

At the connection output, we connected a 0.1µfceramic capacitor in series with 10-ohm resistor to form a Zobel network, a filter circuit having a capacitor and resistor used for adjusting the input impedance.

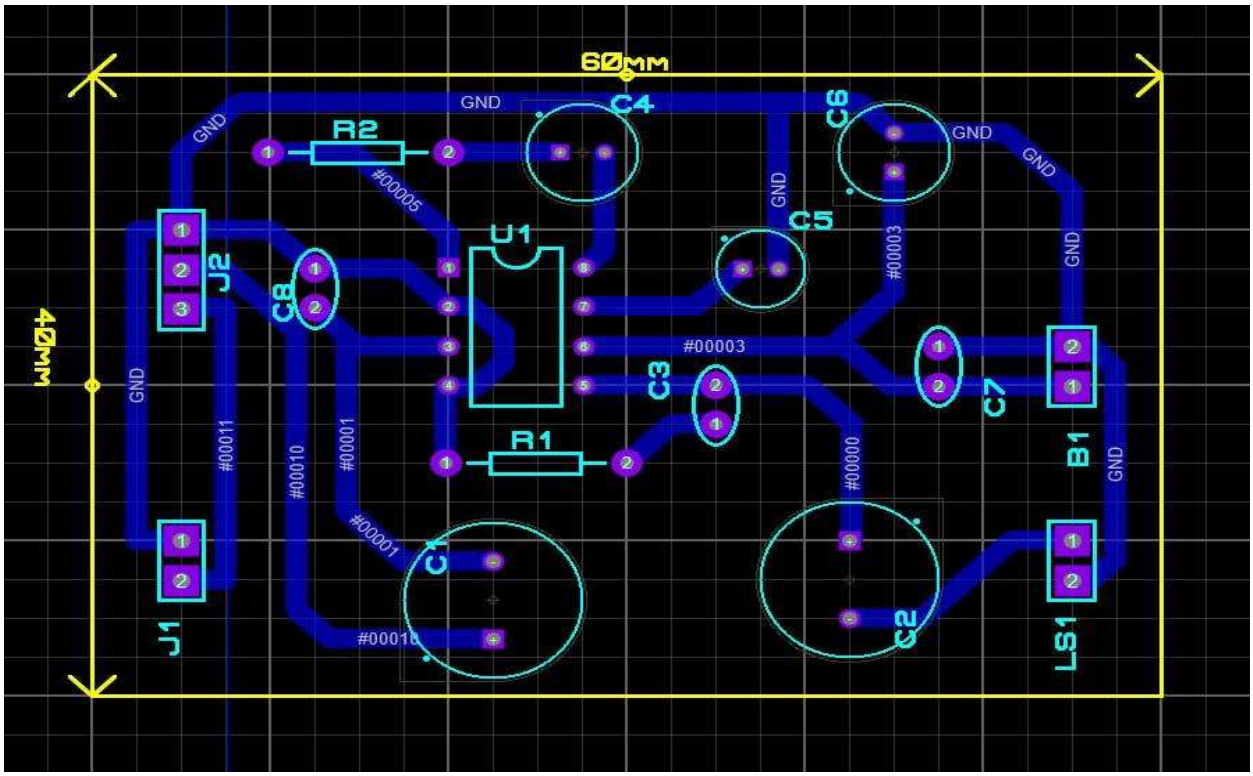
Finally, we connected a coupling 1000uf to the speaker output to remove the unnecessary DC signals.

Now we have a high audio output, low distortion and sharp sound.

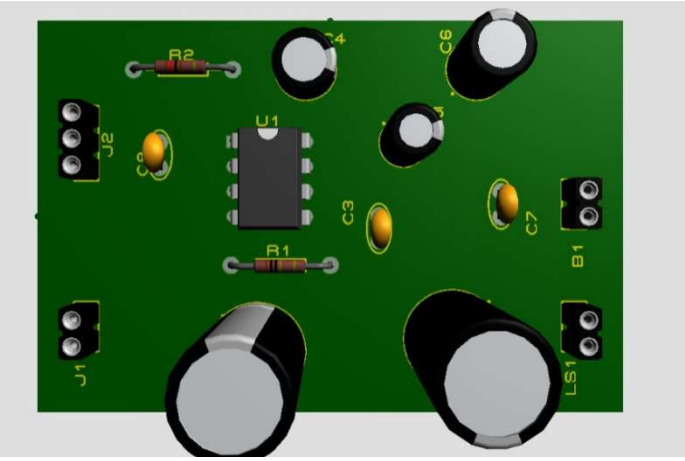
Practical Work

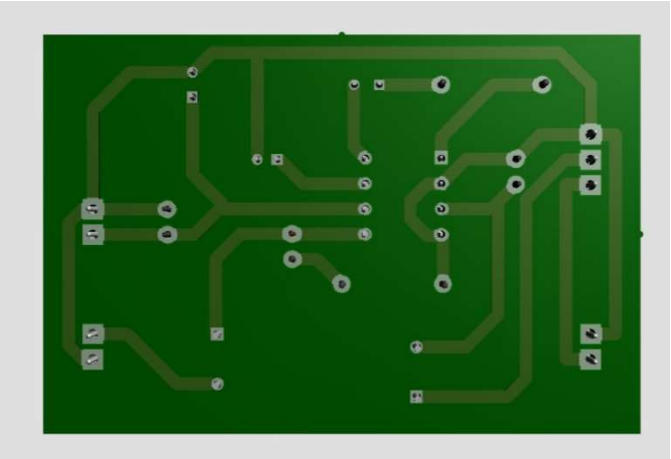
Cleaning the PCB board then printing the PCB layout design on it (using acid and iron), making holes for the components using the driller then soldering the components.

PCB layout

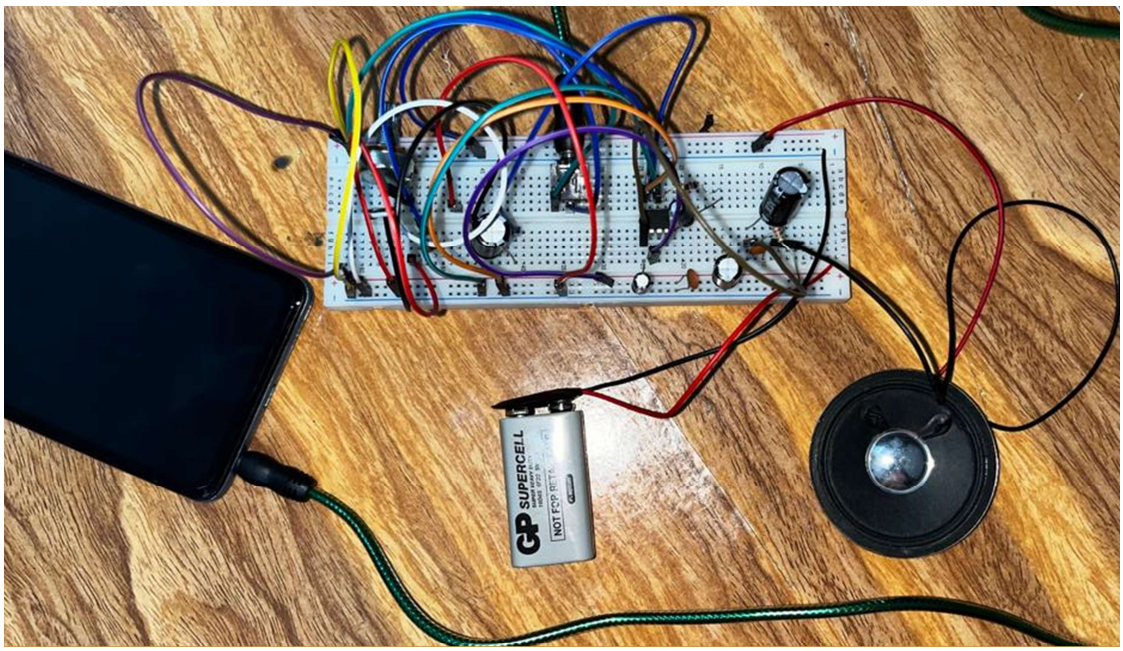


3D Simulation of PCB

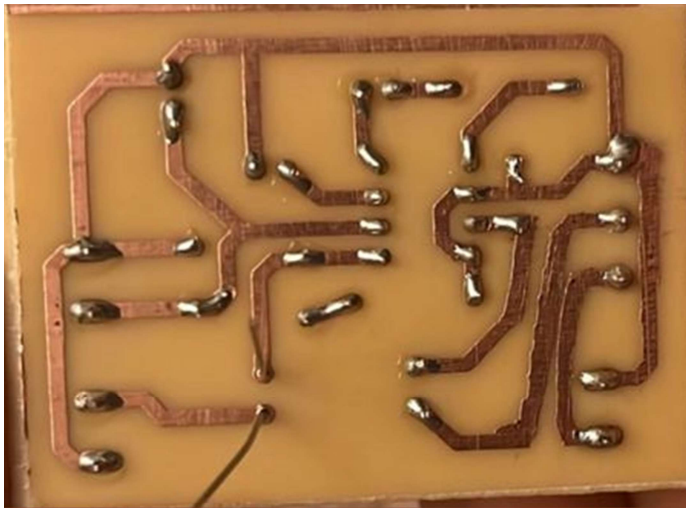




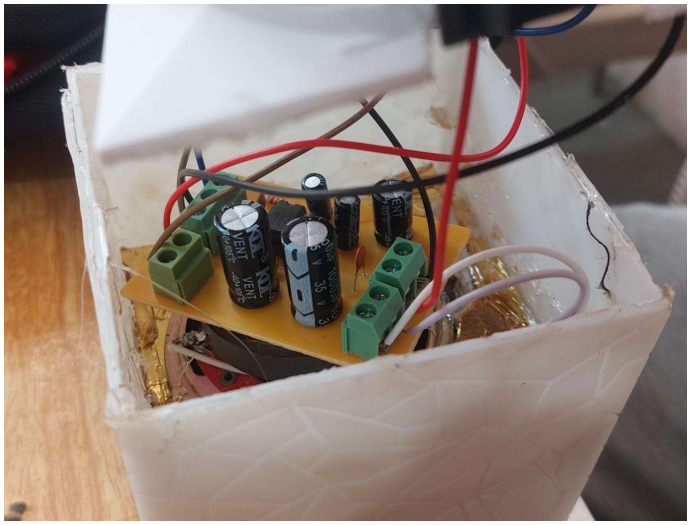
Breadboard

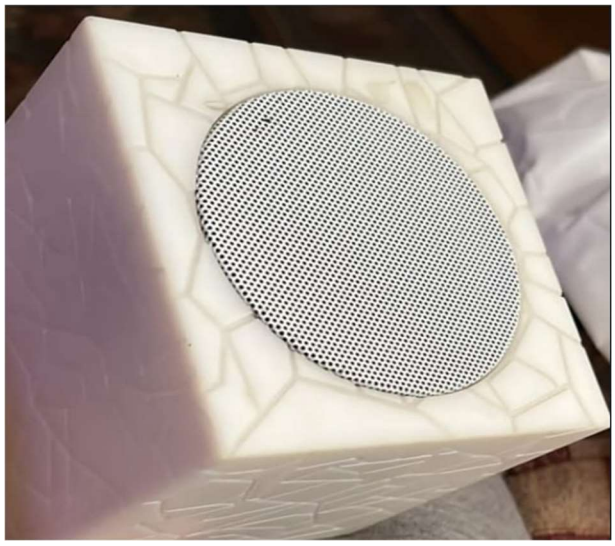


In real life PCB



Final Shape





Conclusion

- Datasheets are essential for each component to use them in the correct way and prevent any bad connections or scattering in the circuit.
- Components should be studied separately to know how exactly how they function.
- Design must be tested on Proteus and Breadboard before printing the PCB chip and soldering the components.
- Circuit must be studied theoretically before applying it physically.

Finally, the audio amplifier operated well in amplifying the sound as we designed, implemented and physically connected the components to.