



Microphone to audio amplifier project

ELECTRONIC CIRCUITS

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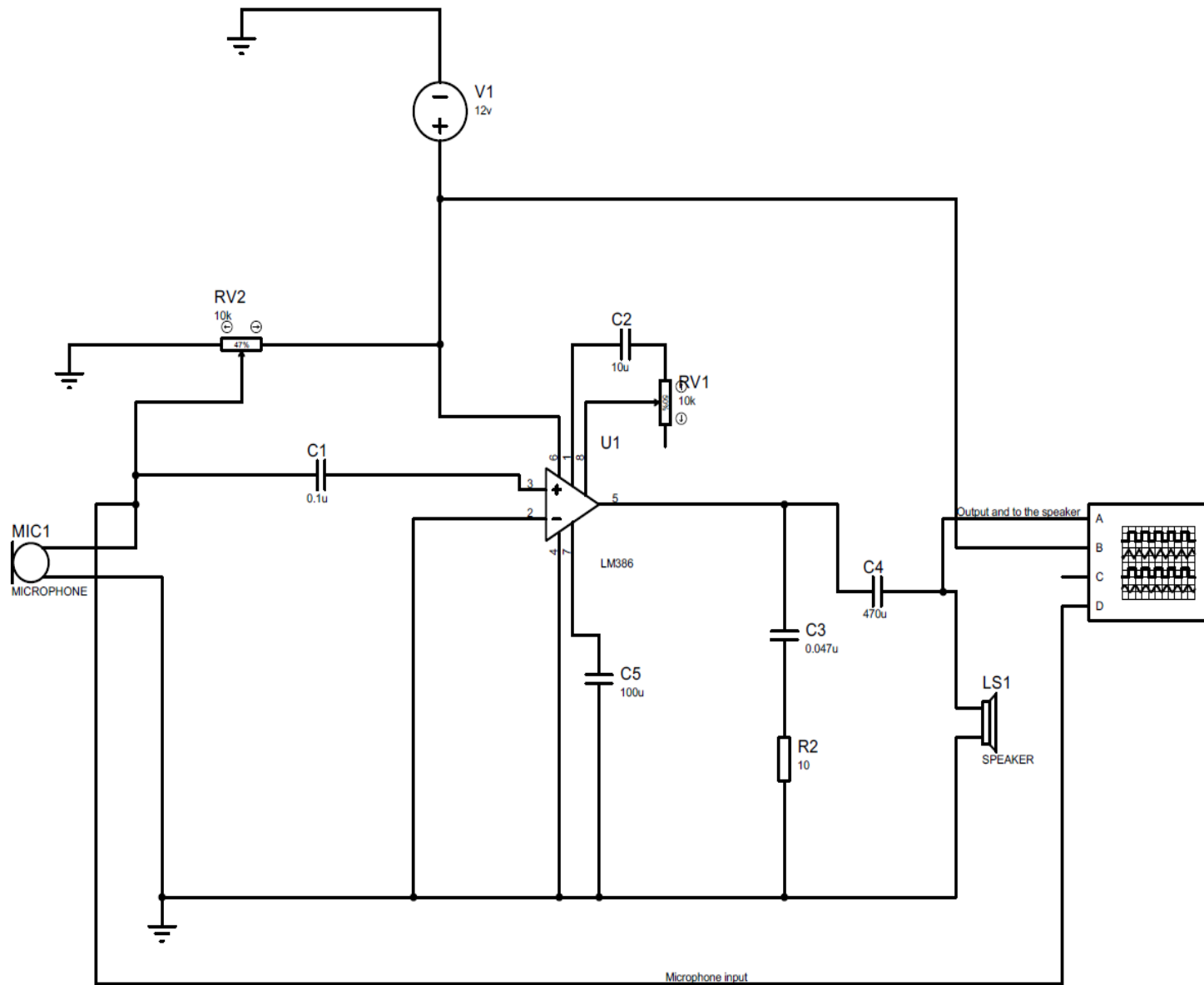
Introduction

Whenever there is a public speech or there is wedding, you always hear the guy's voice loud and clear, even though his voice is not that loud. The guy clearly speaks in a microphone and hear the voice coming from a speaker, so how does that work? Do you just connect both the speaker and the microphone together directly and get the required audio amplification? Turns out, there is a whole internal circuitry between both elements that allows the voice to be amplified, also purified from any sorts of music. In this project we are going to discuss the microphone-audio amplifier circuitry and all the needs and components for this circuitry.

Components

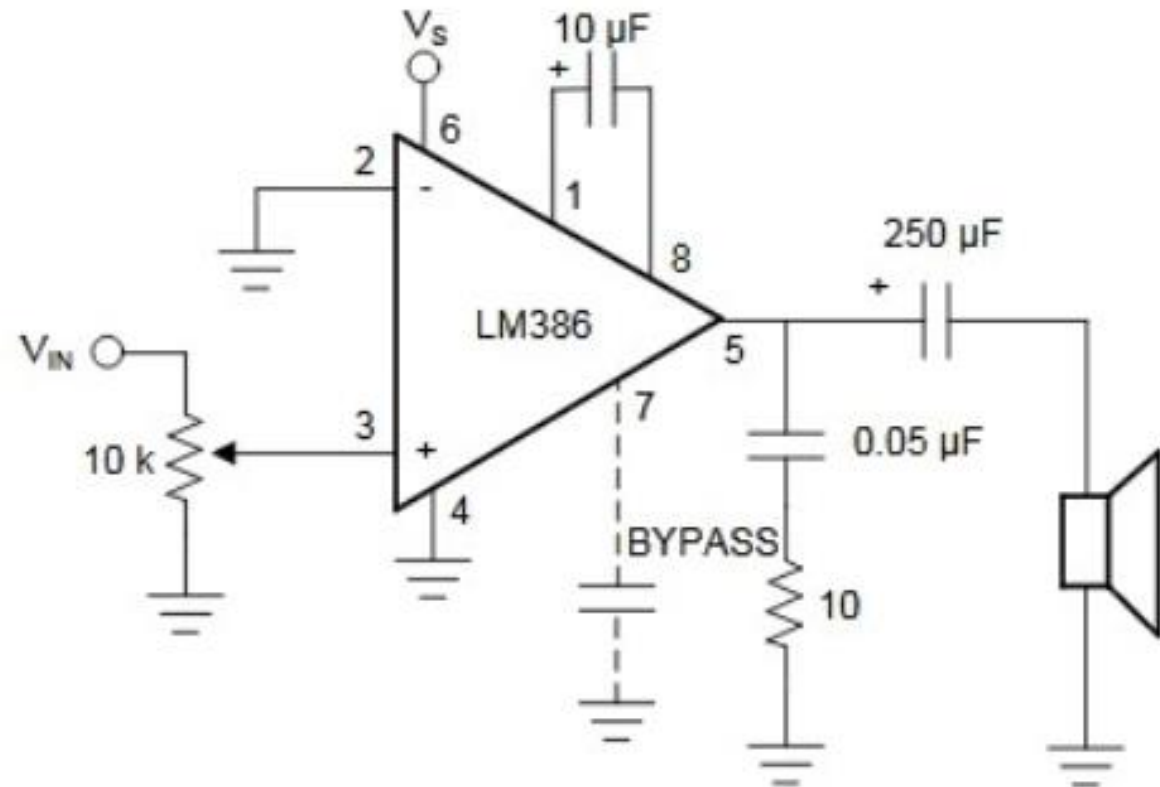
We need the following things to make the **simple microphone amplifier-**

- 1.LM386
- 2.10uF / 16V capacitor
- 3.470uF / 16V
- 4.0.047uF / 16V Polystar Film Capacitor (ceramic)
- 5.10R $\frac{1}{4}$ Watt
- 6.12V Power Supply unit
- 7.8 Ohms / .5 Watt Speaker
- 8.Capsule or Electret Microphone
- 9.0.1uF capacitor
- 10.10k $\frac{1}{4}$ th Watt Resistor
- 11.Bread Board
- 12.Hook up wires
- 13.100uf capacitor
- 14.2* 10kohm potentiometer
- 15.AUX wire and External cell phone



Schematic diagram for the circuit

Simplified view of the project



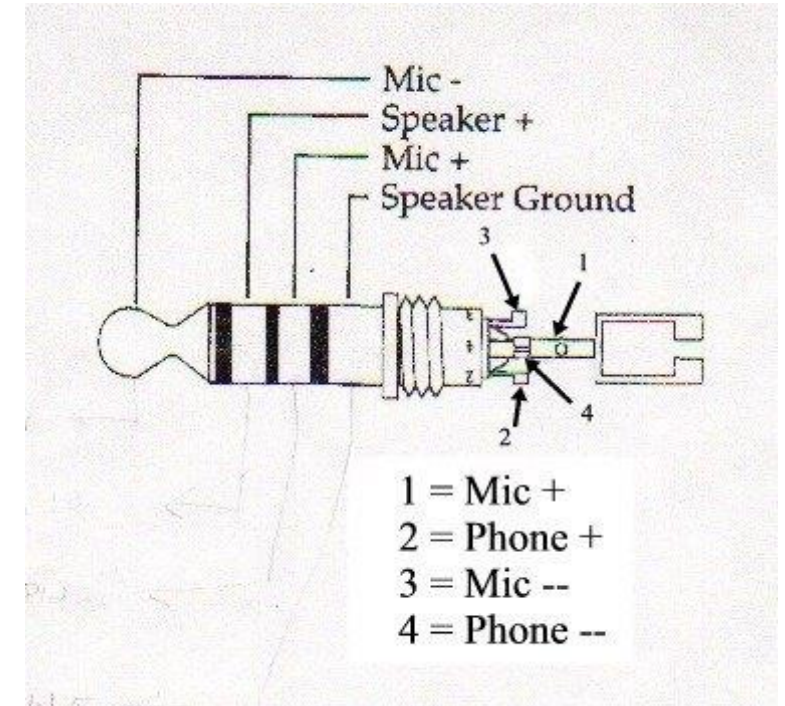
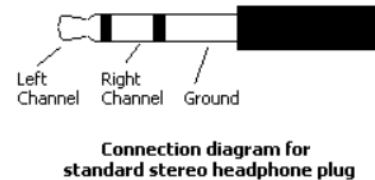
DESIGN PARAMETER	EXAMPLE VALUE
Load Impedance	$4\text{ }\Omega$ to $32\text{ }\Omega$
Supply Voltage	5 V to 12 V

We will discuss
the components
separately

Aux cable

Aux cables are **small, slim wires** used to transfer sound, we used them instead of the microphone where we had some troubles.

There are 3 parts to the audio jack (male) of stereo headphones



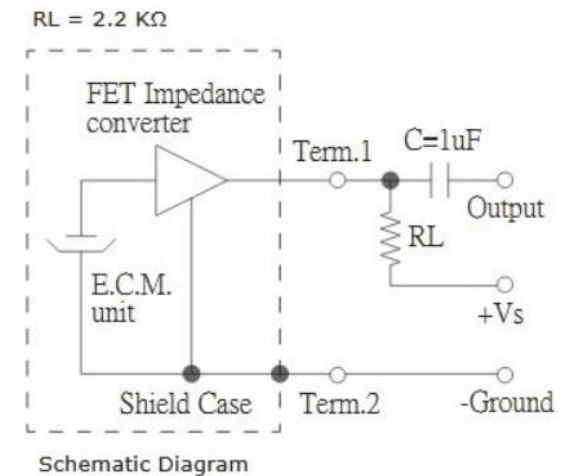
Electret Microphone

In input section, we have used an Electret microphone. Electret microphone uses electrostatic capacitor inside a capsule. It is widely used in a tape recorder, phones, mobiles, as well as microphone-based headphone, Bluetooth headsets.



Internal circuit of an electret microphone

An Electret microphone consists of a Capacitor based material which changes the capacitance by the vibration. The capacitance changes the impedance of a Field Effect Transistor or FET. The FET needs to be biased by an external supply source using an external resistor. The R_L is the external resistor which is responsible for the gain of the microphone. We used a 10k resistor as R_L . We need an additional component, a ceramic capacitor, to block the DC and acquiring the AC audio signal. We used .1uF as our Microphone DC blocking capacitor. The total resistive load inside the electrets microphone is 2.2K



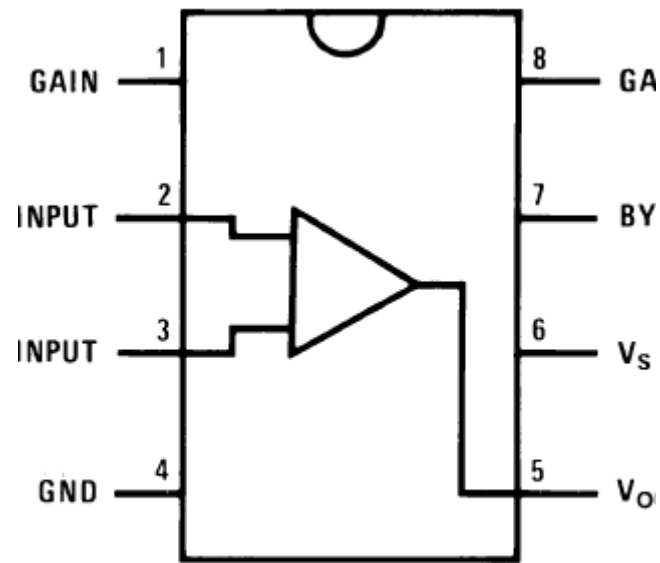
About the E.C.M and the FET

Electret condenser microphone(E.C.M) apply the principle of capacitor charge and discharge operation. The diaphragm acts as one plate of a capacitor where the vibration generated due to sound waves produce the changes of charge between the plates to make the signal transmission.

FETs are primarily used as impedance converters in condenser microphone, the condenser microphone capsule works as a transducer, converting sound waves (mechanical wave) energy into audio electrical signal, the condenser capsule have incredibly large output impedance and drive barely any current, this where the impedance converter (FET) comes into play. FETs, by design, have extremely high input impedances at their gates. The impedance at the drain, however, is much lower and allows for current to flow.

So, the capsule's output signal is sent directly to the gate of the FET. This AC signal alters the conductivity between the drain and source terminals and, therefore, alters the current at the drain and, ultimately, the “output” voltage of the FET.

LM386N-1 audio amplifier

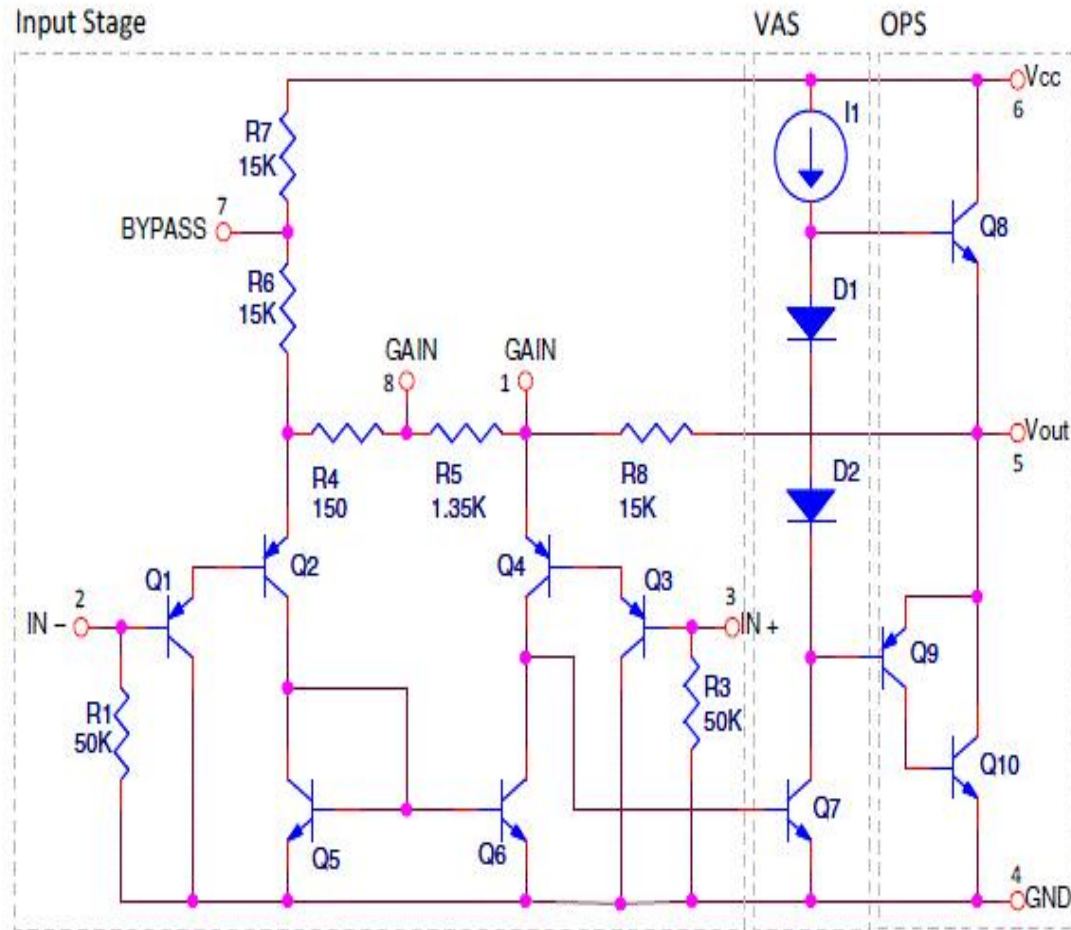


LM386 Pin Diagram

To connect the IC in breadboard or soldering in Veroboard, we need to know the pin diagram of the Power Amplifier IC LML386. Pinout and Pin description of **LM386 audio amplifier IC** is given below.

PIN 1 and 8: These are the gain control PINs, internally the gain is set to 20 but it can be increased up to 200 by using a capacitor between PIN 1 and 8. We have used 10uF **capacitor C3** to get the highest gain i.e., 200. Gain can be adjusted to any value between 20 to 200 by using proper capacitor.

Pin 2 and 3: These are the input PINs for sound signals. Pin 2 is the negative input terminal, connected to the ground. Pin 3 is the positive input terminal, in which sound signal is fed to be amplified. In our circuit it is connected to the positive terminal of the condenser mic with a **100k potentiometer RV1**. Potentiometer acts as volume control knob.



Internal design

Pin 4 and 6: These are the power supply Pins of IC, Pin 6 for is +Vcc and Pin 4 is Ground. The circuit can be powered with voltage between 5-12v.

Pin 5: This is the output PIN, from which we get the amplified sound signal. It is connected to the speaker though a capacitor C2 to filter DC coupled noise.

Pin 7: This is the bypass terminal. It can be left open or can be grounded using a capacitor for stability

The IC consists of 8 pins, Pin - 1 and pin - 8 are the gain control pin. In the schematic 10uF capacitor is connected across pin 1 to pin 8. These two pins set the output gain of the amplifier. As per the datasheet a design, the 10uF capacitor is connected across these two pins and due to this, the output of the amplifier is fixed to 200x



Speaker

The speaker is a 25ohm speaker which does the exact opposite job to the microphone where it converts the electronic signals back to audio signals and through the controllable gain you control the volume of the device.

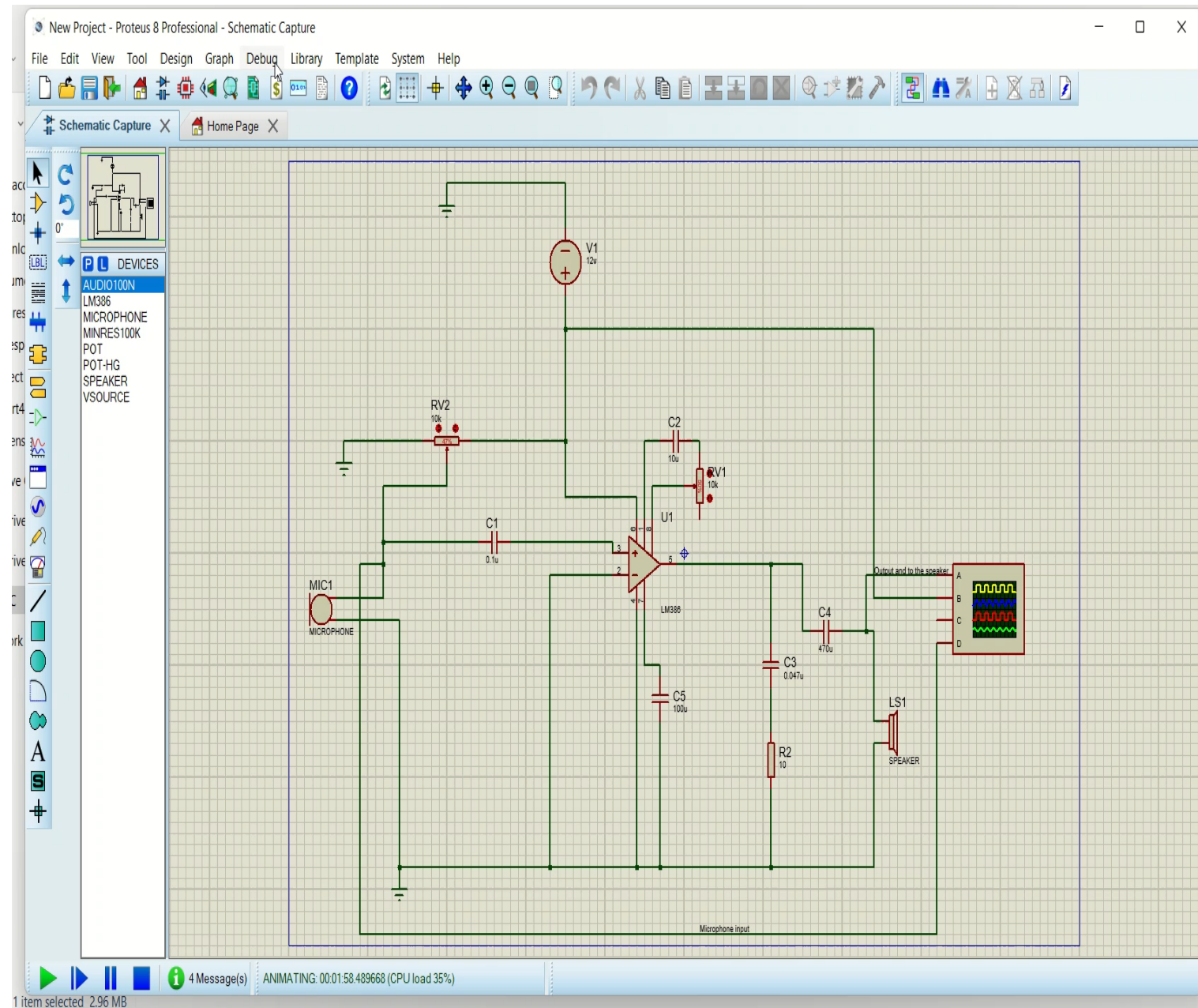
Now we are
going to go
through the
wiring part
by part

Starting from pins number 2 and 4 which are the inverting negative input and the ground respectively, these are directly connected to the ground. Pin number 7 which is the bypass is connected to the a 100uf capacitor which limits the non-linear distortion of the device. Pins number 1 and 8 are responsible for the gain and are connected to each other through 10uf capacitor and a variable resistor of 10kohms. This connection between pin 1 and pin 8 is responsible for increasing the gain to 200x, and through the potentiometer we can control that gain.

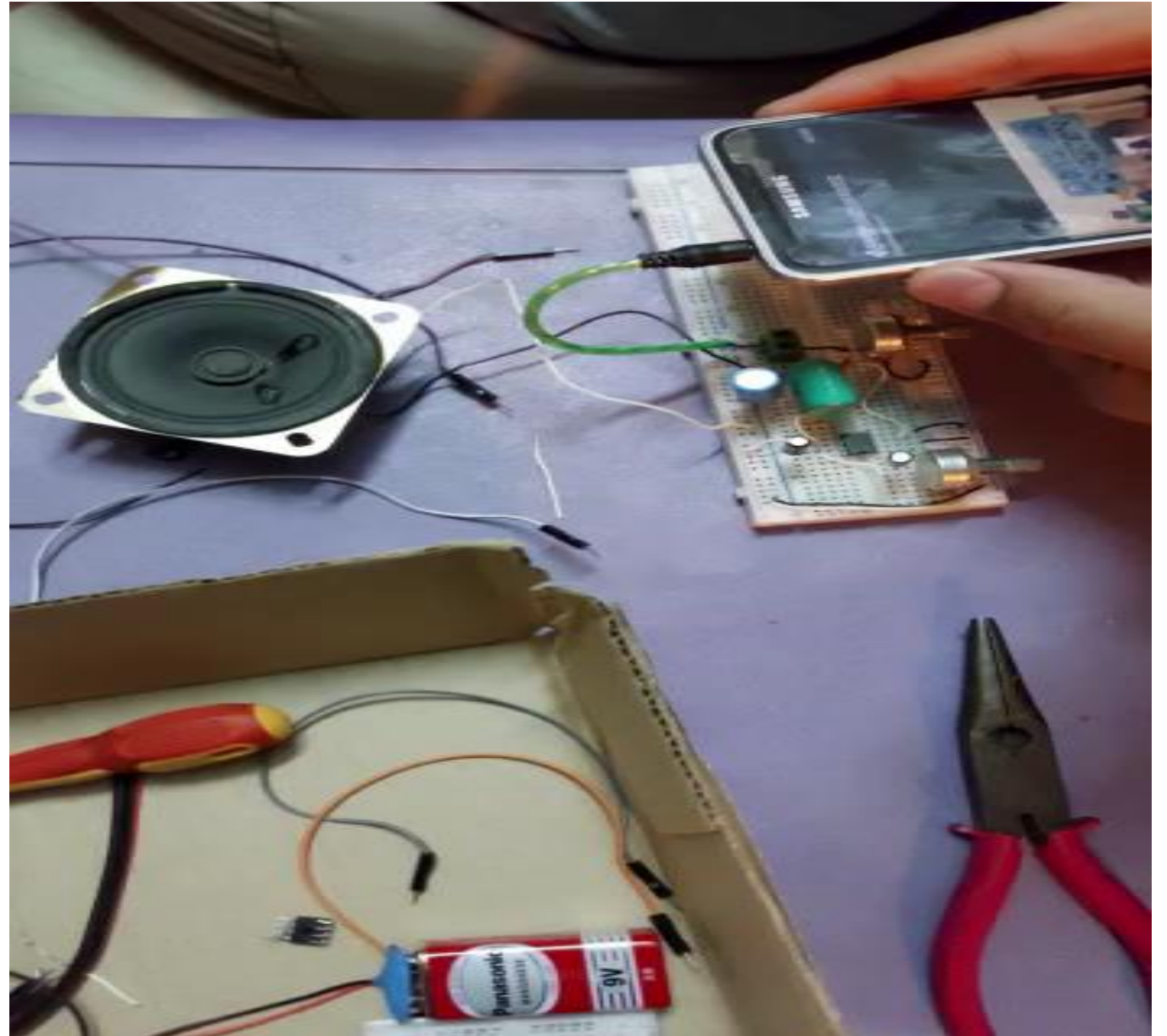
The rest of the wiring

Going out of pin 5 there are two paths, one which goes through a 470uf capacitor that is used for DC coupling to cutdown DC voltages and very low frequency harmonics and noise then to the speaker to output the audio signal, and the other one through a parallel R-C filter of 0.047uf capacitor and 10ohm resistor, this filter is to get rid of very high frequencies where it forms a short circuit to the ground at very high frequency. The pin number 6 is directly connected to the Vcc terminal. Pin number 3 goes through 0.1uf ceramic capacitor that is attached to the positive AUX terminal of two channels after we converted them to monotone. The terminal is to the ground. There is a feedback from a 10kohm potentiometer coming from Vcc as indicated in the schematic.

Simulation of the project



Real time video





Thank you
