

FOURTH SEMESTER ECD PROJECT REPORT

Listening Bug

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APRIL/MAY 2023



ABSTRACT

Listening bug has always been used at large scale by the government and detective agencies for safety and spying purposes. For instance, government uses listening bug for keeping track of terrorists group by continuously listening their conversation through listening bug device planted in their area, while detective agencies use it for hearing conversation between suspects of crime. But this project is small scale listening bug which is made for general purposes. This small-scale bug is useful for parents who wants to keep track of their kid while working in different room or place by constantly monitoring their kids through their voice.

The main component focused in the project is op-amp 741. Here, op-amp 741 is used for amplifying purposes. This component is used as inverting mode amplifier to amplify signals produced by microphone. Along with op-amp other components like microphone works as receiver end and loudspeaker works as transmitter end for signals.

During the process of making of this project, it was figured out that listening bug operates perfectly if its sensitivity is enough to sense our normal audible voice. Voltage sensitivity is the most important aspect of this bug. In op-amp pure dc voltage is applied at pin 7 while grounded at pin 4. The amplified output through pin 6 is further applied and given as output.

The conclusion is that op-amp 741 work as amplifier which is main driving force of circuit while resistance is used for increasing sensitivity to catch every small noise. The capacitor present in the circuit will help in smoothening of the signals. While the microphone and speaker is working as input and output respectively.

Chapter-1

INTRODUCTION

Listening bug is a simple circuit which can be used for spying purposes. Using this device, one can hear conversation held in any other room. This project is a small-scale implementation of this device. Listening bug can be wired or wireless, but wireless bug was not that cost effective and something affordable was needed hence wired listening bug was taken as an option. This circuit generally consists of microphone, speaker, op-amp, and various other small components.

This project mainly focuses on low level safety. People can use this in their offices or homes. This product is mostly helpful for parents with infants as this small-scale bug is mostly used as baby monitor. As general public cannot afford to buy this device if it's costly, so the aim of this project is trying to make it cheap and available to general public. This device can also be used by senior citizen who cannot walk on their own to call someone inside their house, this device can be very helpful for them.

1.1 Block Diagram:

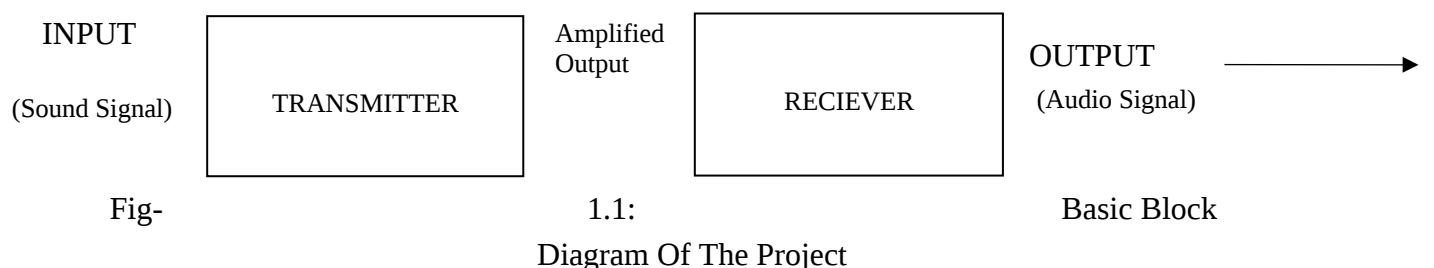


Fig-1.2: Pin
UA741

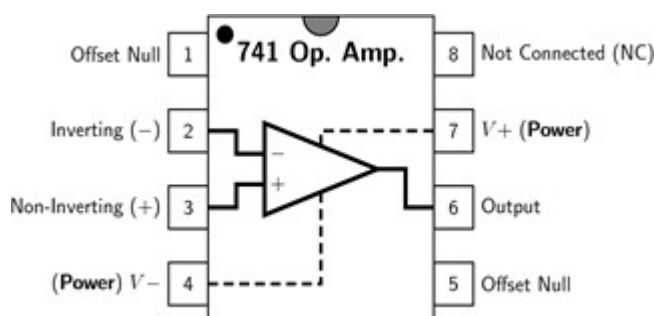


diagram of IC

Chapter-2

METHODOLOGY

The sound signal is passed through microphone which is then converted to electrical signal by the microphone. A wire is connected from microphone to inverting pin of op-amp which is pin 2 of op-amp through resistor of 1kilo-ohm and capacitor of 0.2 micro-farad. The output given by op-amp through pin 6 is given to the base of NPN and PNP transistors in the circuit. Then a resistor is connected to set a voltage at pin 3 which is non-inverting pin. Then a pure dc voltage is supplied at pin 7 whereas pin 4 is grounded. The output is now amplified and given through pin 6 and this output is then passed through the two transistors, which will further amplify the output at the receiver's end. The 470 micro-farad capacitor is used to filter out dc components present. At last, the signal is passed into loudspeaker and the final output required is obtained.

2.1 Circuit Layout

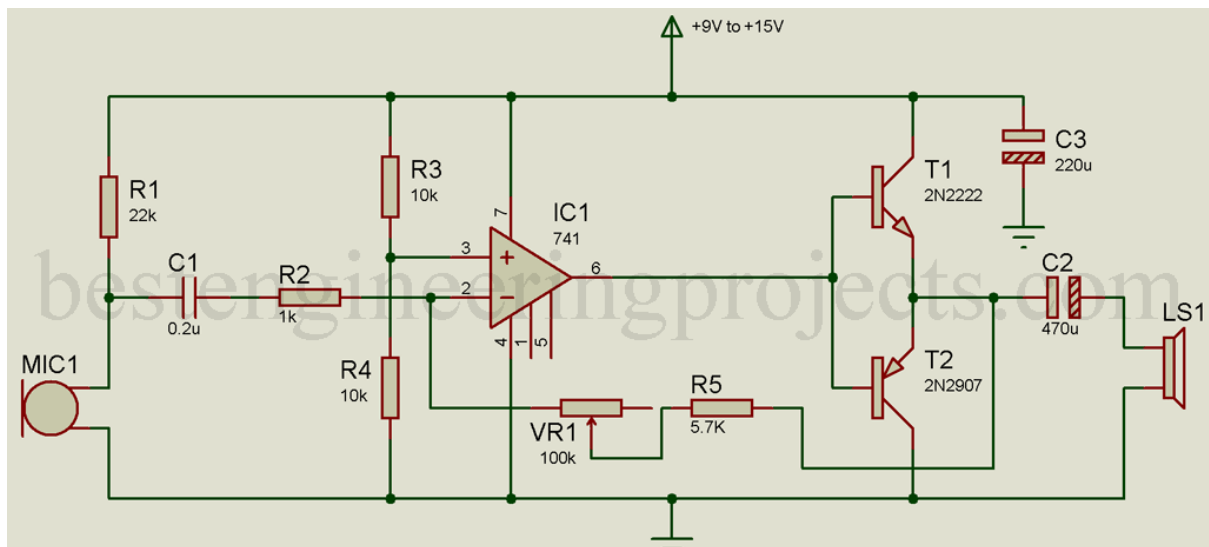


Fig-2.1: Listening Bug Using OPAMP - 741

2.2 Components Specifications:

- Resistors(22k Ω ,1k Ω ,10k Ω ,5.7k Ω)
- Ceramic capacitor – 0.2 μ F
- Electrolytic capacitor (470,250 μ F)
- IC – LM741
- Transistor (2N2222,2N2907)
- Condenser microphone
- 4 Ω loudspeaker
- Breadboard
- Connecting wires

2.3 Justification Of Components Used:

Ceramic capacitors: These capacitors have fixed value and ceramic acts as dielectric. The range of these capacitors lies between 10pico-farad and 0.1micro-farad. This capacitor is cheap and easy to manufactured than another capacitor.

Resistors: These components are simple electronic device which helps to reduce flow of current and adjust signal levels.

Electrolytic Capacitor: This is polarized capacitor whose anode and cathode are made of metal that is taken to formation of oxide layer through anodization. Here the oxide layer acts as dielectric.

IC-LM741: This is a dc-coupled high gain electronic voltage amplifier. This is an operational amplifier which is used as comparator which compares inverting and non-inverting signal.

Transistor: This is made of semiconductor which is used for amplifying and switching electrical signal and power.

Microphone: This is transducer that converts sound into electrical signal.

Loudspeaker: This electric device converts an electrical audio signal into a corresponding sound.

2.4 Calculation:

$$\text{Gain } (A_v) = -(R_{\text{feedback}}/R_{\text{equivalent}})$$

$$A_v = -(V_{R1} + R_5)/(R_2 + Z_{c1})$$

- $V_{R1} = 65\text{K } \Omega$ - $R_2 = 1\text{K } \Omega$
- $R_5 = 5.7\text{k } \Omega$ - $Z_{c1} = 1/s \times 0.2\text{u} = 15.9\text{k } \Omega$

$$A_v = -3.000 \text{ (Practical Value)}$$

$$A_v = -3.056 \text{ (Simulated Value)}$$

Negative Sign shows it's an inverting amplifier.

Chapter-3 RESULT ANALYSIS

3.1 By varying Potentiometer (R8) to reduce possible noise

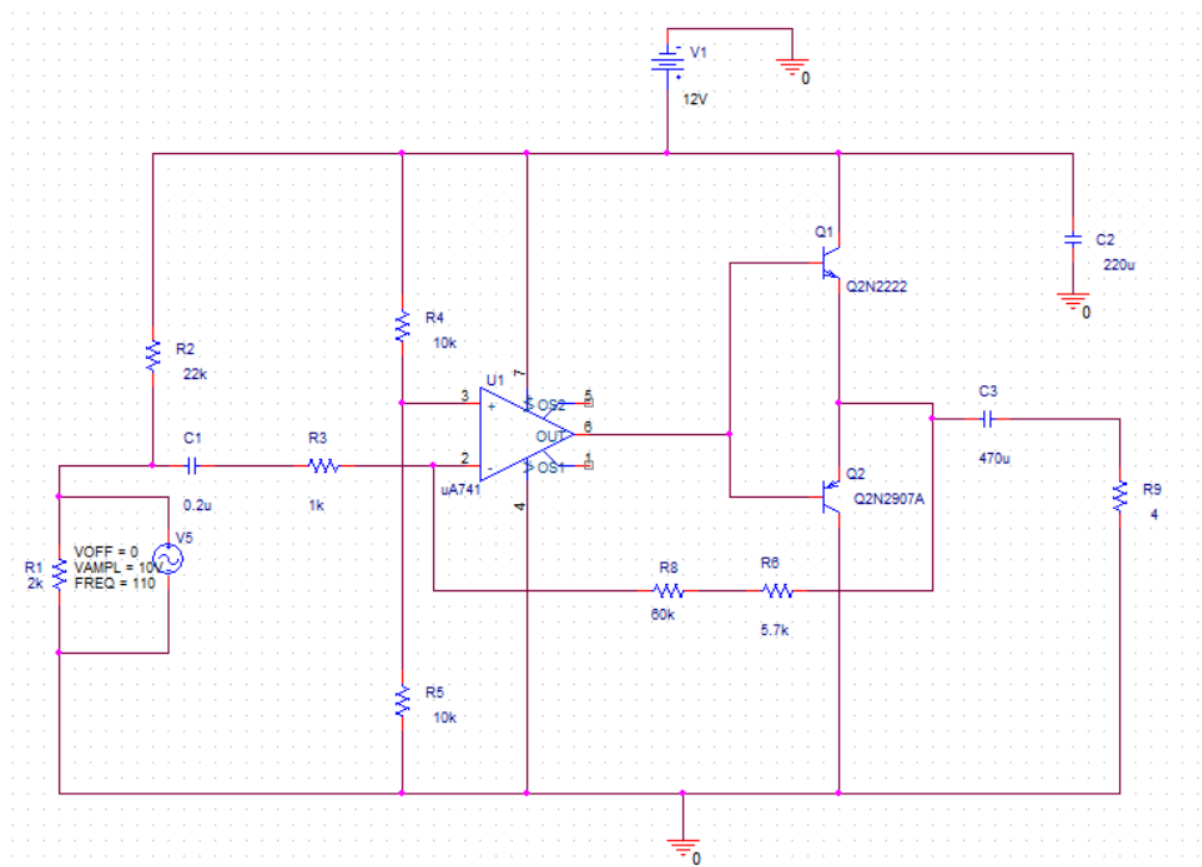


Fig-3.1: Simulation on LT Spice

- By varying Potentiometer to 5kohm

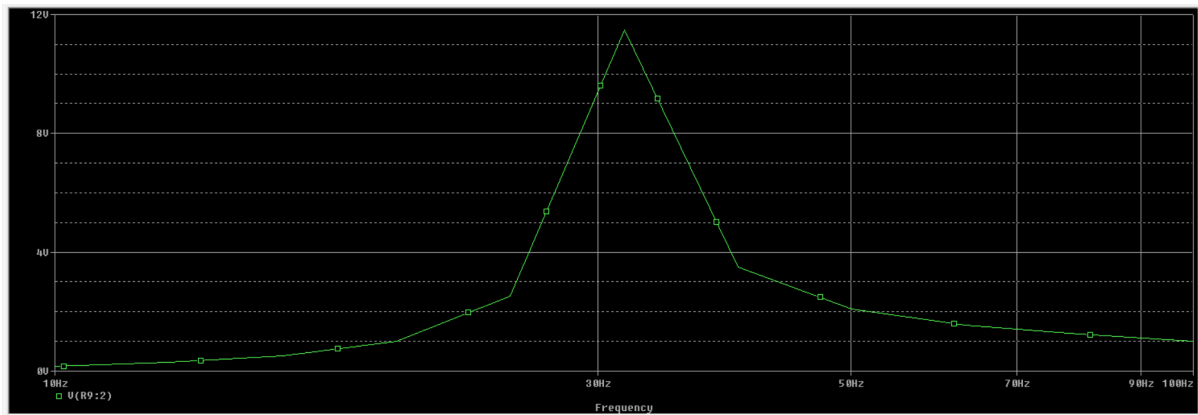


Fig-3.2

- By varying Potentiometer to 10kohm

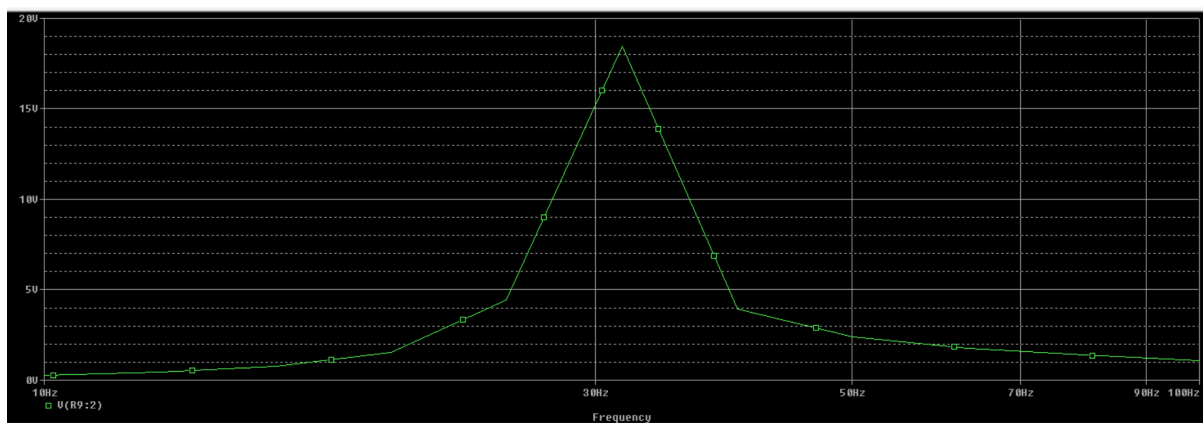


Fig-3.3

- By varying Potentiometer to 30kohm

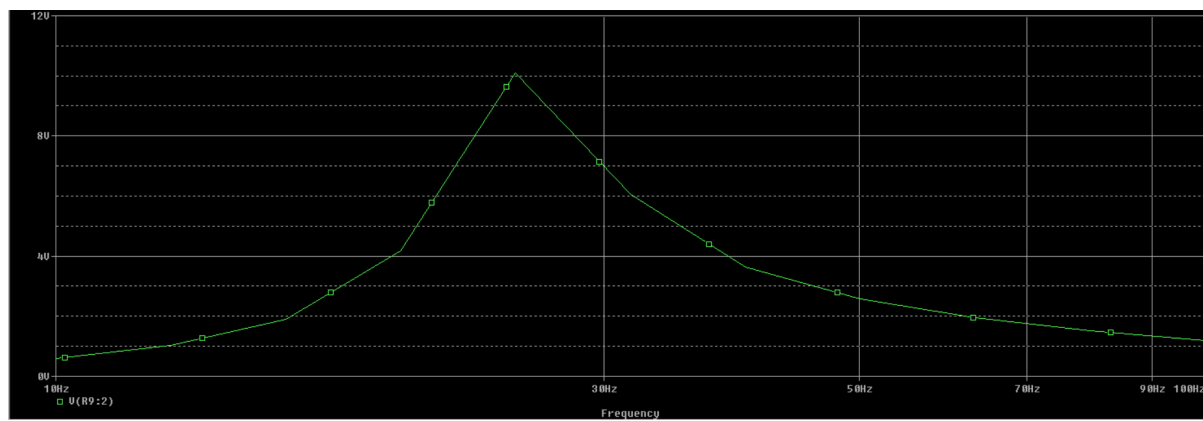


Fig-3.4

- By varying Potentiometer to 60kohm

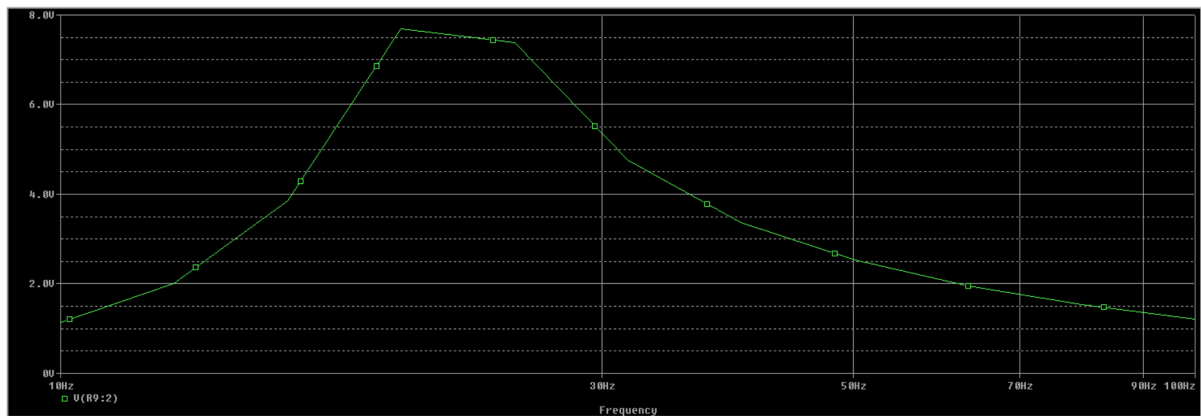


Fig-3.5

3.2 Voltage And Current Analysis Of The Circuit:

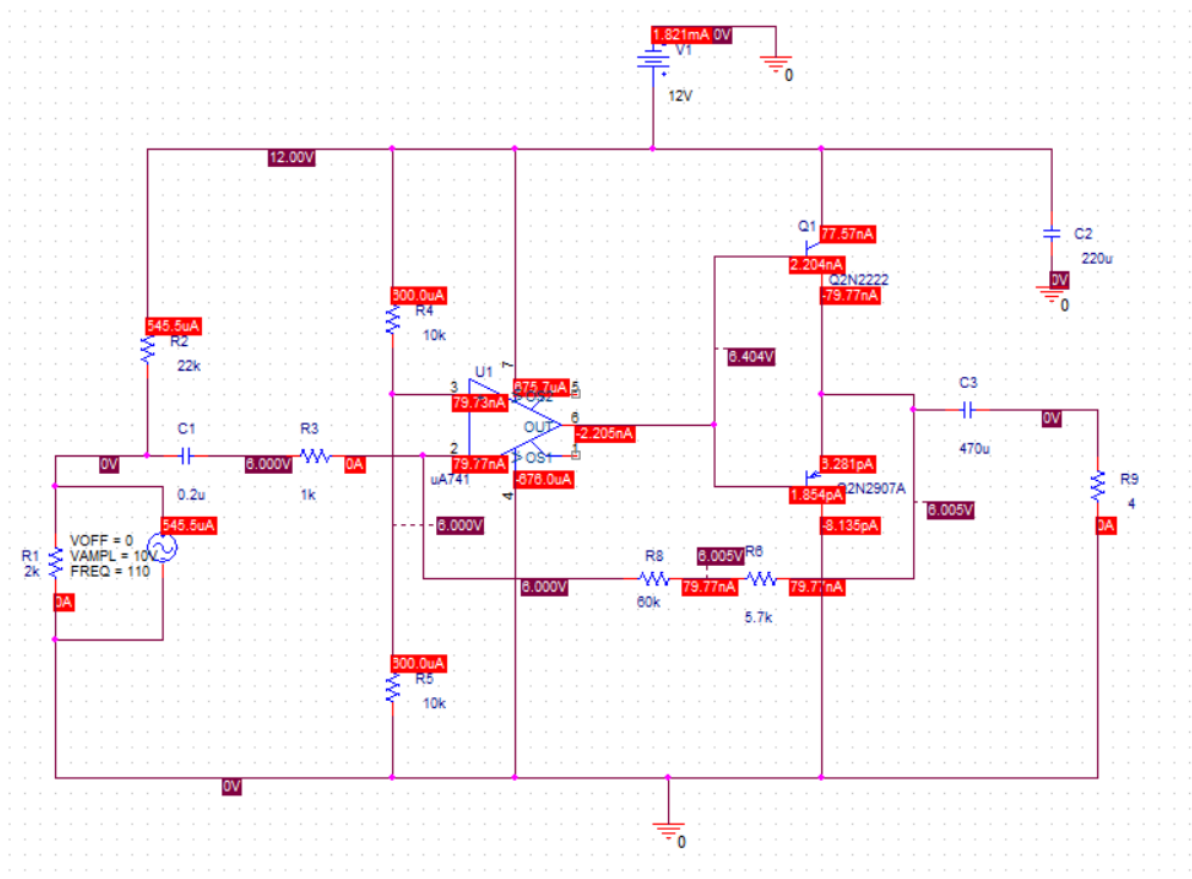


Fig-3.6: Analysis On LT Spice

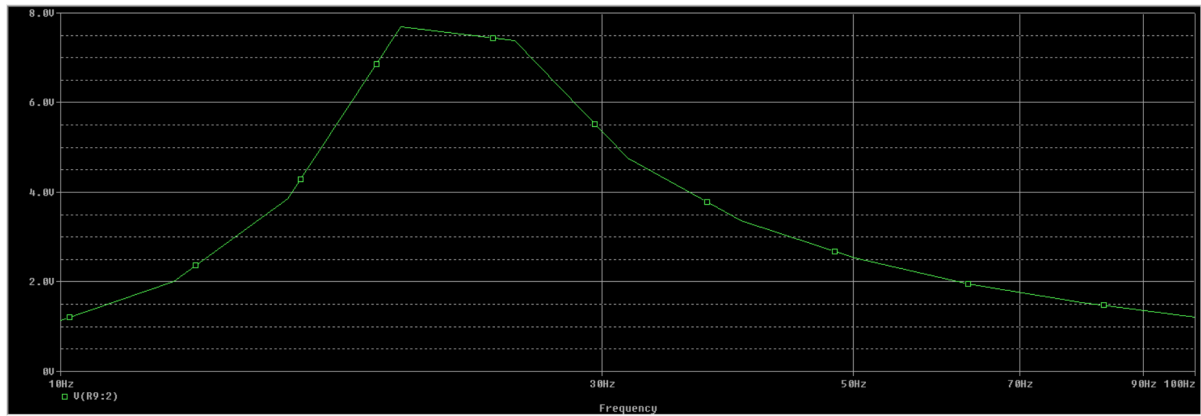


Fig-3.7: Output Waveform on LT Spice

With different practical values of potentiometer in circuit, choosing the correct resistance value will be smoothening the signals properly and as well give enough bandwidth to pass amplified audio signal to speaker.

3.3 Significance Of The Result:

Theoretical value of potentiometer: 60k Ω

Practical value of potentiometer: 65k Ω

These graph shows that the circuit works most perfectly at 65k Ω . The second circuit shows that capacitor is smoothening the signals properly.

This device is giving some noise at the output so a filter can also be added to this circuit for further advancements to have a clarity in the output sound.

Chapter - 4

CONCLUSION AND FUTURE SCOPE OF WORK

The listening bug, which uses the IC 741 as its main component, is primarily used for surveillance purposes, such as spying and police investigations. This device is beneficial for gathering confidential information without alerting the target, allowing for the tracking down of criminals and strengthening national security. Additionally, its small size makes it easy to conceal and install in a specific location.

One potential future development is to make the device wireless, allowing it to be connected to mobile phones and increasing its accessibility. However, this would require significant technical advancements and careful consideration of ethical and legal implications.

Another potential enhancement would be to add a camera to the listening bug, which would allow for visual monitoring of the area under surveillance. This would significantly improve the device's functionality, but it would also require additional components, such as image

sensors, processors, and storage devices, resulting in increased complexity and technical challenges.

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