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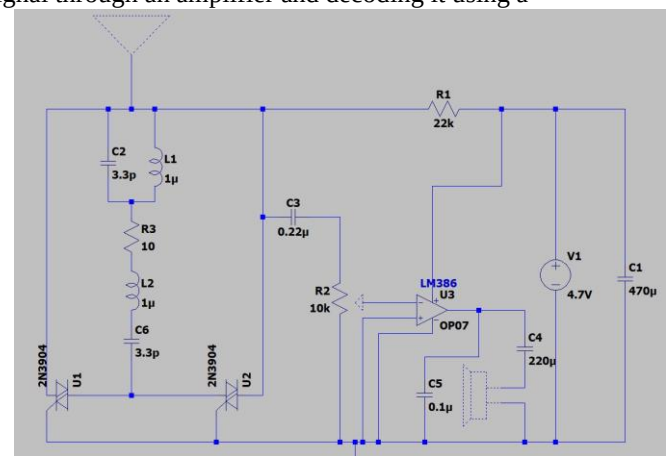
RF Frequency Based Walkie-Talkie

We aim through this project to make an electronic radio receiver that takes the modulated frequency from the radio transmitter which takes audio input from the microphone module and then transmit through the Antenna which are received by Radio receiver Circuit that Receives the RF Signal emitted from transmitter and then passes through the Filter for Noise Removal then deliver to the speaker to an audible frequency. The primary objective of this project is to make communication easier and more efficient. The project will use an antenna, Op-amp, transistors to catch, then filter and then amplify the signal then to transfer it to the speaker that will convert the signal into sound. This is a highly cost-effective and a very simple project focusing on practicality and common usage, making it Ideal Wireless Communication Medium.

Keywords—Basic circuit elements, Transistor, radio, cost-effectiveness.

I. Introduction

A radio receiver is used to capture radio waves transmitted through the air and convert them into usable audio signals. It operates by selecting a specific frequency from a range of electromagnetic waves using a tuner, amplifying the weak signal through an amplifier and decoding it using a demodulator to retrieve the original information.



II. Schematic Design

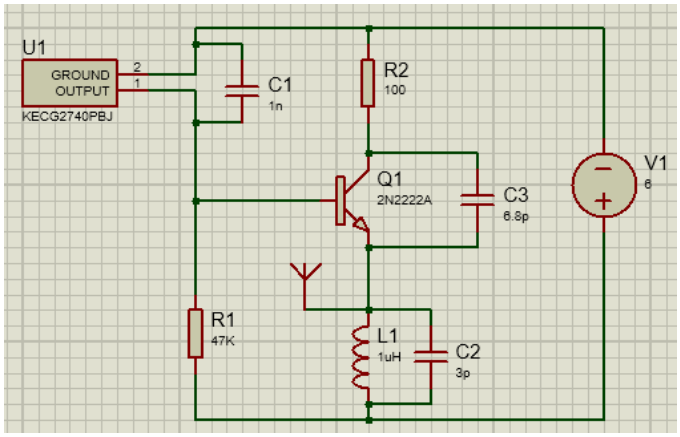
Fig. 1. Schematic Diagram of the receiver

A turner circuit is used to select a specific channel, and Filter is used to filter out unnecessary noise two transistors and Op-amp to amplify frequency and a potentiometer to increase or decrease volume. A capacitor between Op-amp and speaker to remove dc signals and a capacitor between +ve and -ve terminal of voltage source to regulate voltage.

The Second Circuit is of Radio Transmitter that is synchronized with the Radio Receiver. Both works simultaneously meanwhile the output also obtained by the radio in Mobile Phone application.

TABLE I
UNITS

Symbol	Quantity	
HZ	Frequency	Base unit



III. Methodology

Materials Used: Transistors (2N3904 & 2N2222A), capacitors multiple (22pF, 0.22uF, 220uF, 0.1uF, 0.470uF, 221uF), Resistors (22k, 10k,10, 47k), LM386 IC (Operational Amplifier), Inductor, antenna and speaker.

Methodology: In the RF receiver there are three main parts Tuner, Filter and then Amplifier. Tuner selects a specific frequency then unnecessary frequencies are filtered through RLC Filter. For amplification we use two 3904 transistors and an OP-Amp. In RF Transmitter there are also three parts. Audio Input, Amplification (2N2222A), and a tuner to transmit at specific frequency.

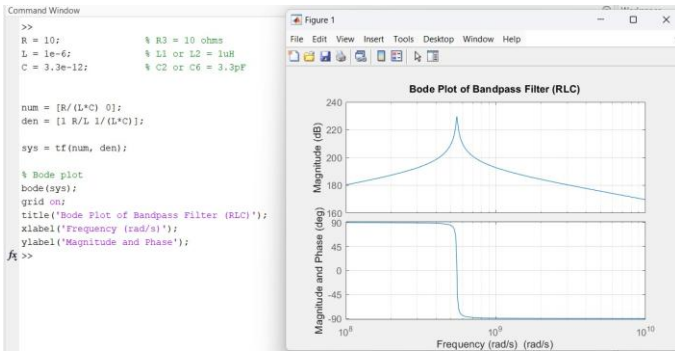
$$f = \frac{1}{2\pi(\sqrt{LC})}$$

$$f = \frac{1}{2\pi(\sqrt{3 \times 10^{-12} \times 1 \times 10^{-6}})} = 91.88\ Mega\ HZ \quad (1)$$

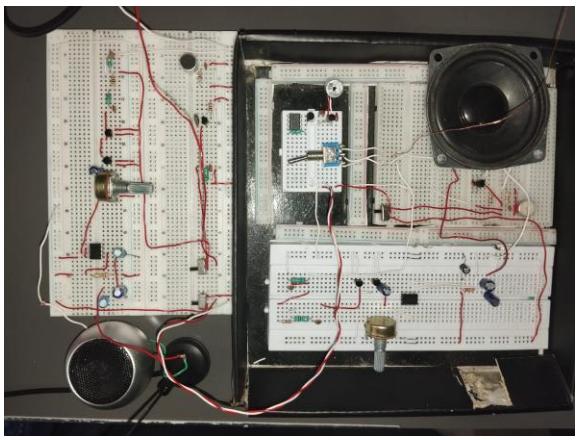
IV. Results and Discussion

Expected Frequency	Experimental
91.8 MZ	94.3 Mega HZ

Results: Both circuits are tested by setting up the power supply and areal on a relatively higher ground and the circuit produces an audible signal with some noise and static in between the audio of the radio transmitter.



From the Circuit Firstly we developed the Band-Pass filter for the radio receiver of required frequency then the Bode Plot is made by MATLAB to study the behavior on various frequency levels.

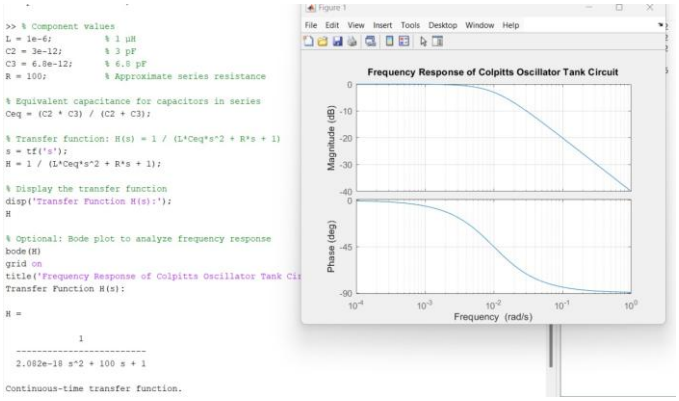


Discussion: Both circuits functioned effectively and performed as expected. However, there was an issue with noise due to the absence of a proper antenna for transmission and reception. This affected the signal clarity and consistency. Despite this, the core circuit behavior aligned with our design objectives.

Conclusion

The walkie-talkie project successfully demonstrated two-way communication using basic RF modules. While the overall performance met expectations, signal quality was limited by the lack of an optimized antenna. With proper antenna implementation, the system can be significantly improved for clearer and more reliable communication.

For future improvements, using more precise components with lower tolerances could reduce discrepancies. Additionally, adding a properly tuned antenna will greatly improve range and signal clarity. Incorporating encryption or digital modulation can enhance security and communication quality.



The Transfer function of the frequency generation unit of the Radio Transmitter is1 developed using MATLAB.

References

Books:

[1] Basic Engineering Circuit Analysis by J. David Irwin & R. Mark Nelms

Internet:

[2] FM Receiver Circuit by EDN Network

[3] FM Transmitter Circuit

[4] RF Spectrum Guide by arrow.com