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Baseband Coding for Audio Steganography

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Abstract: ***This paper describes "Baseband Coding for audio Steganography" deals with hiding and sending data in multimedia files. Here we will try to send a code through music. The code will be inserted in to the waveform through audio mixer and hardware PWM. While the listened mixed output will be heard all most same to same as the original song. Only who knows the decoding technique will be able to extract the codes. A microcontroller based circuit is used as a mixer and some techniques of audio signal processing are used in this project. In the preliminary stage i.e. in the simulation part(using the c# codes ,not the hardware) we were able to send the following five alphabets – 'A', 'B', 'C', 'D', 'E', 'F' successfully . Later we are trying to send all twenty six alphabets using the mixer hardware.***

Key words:Here we will try to send a code through music.

I.INTRODUCTION

From ancient Greece to the modern days Steganography became popular for data secrecy. Previously data hiding in image is done in multiple fields. In my project the data is hided in a music file. The data consist of several alphabets. While hearing the mixed output it will be heard all most same to same as the original song. Only who knows the decoding technique will be able to extract the codes. The motivation behind this work lies in its simplicity and application area

- ❖ The analysis is simple in the sense that it is using the common Cooley-Tukey algorithm for FFT i.e. audio signal processing. This technique can be implemented by microcontroller based circuits..
- ❖ The proposed technique has a wide range of application. Here we are sending only some sequence of alphabets. We are using common music sources such as mp3 players, laptops etc. If high quality sound cards are used and the code as well as the hardware can be so developed that it can process sequence of sentences.
- ❖ The most interesting and significant part of our work is Steganography i.e. data hiding. We are broadcasting data enveloped in a music file. The mixed output is available worldwide but only the receiver can extract the data from the music. The receiver must know the decoding technique. The main fact is that it appears to entire world except the receiver that it is simply a music file, nothing else.

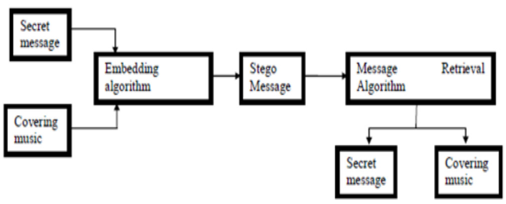

Figure 1: Flowchart of traditional Steganographic technique.

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The above flowchart simply describes the traditional Steganographic technique. In the sender side the sender will send the secret message with the covering music through embedding algorithm. The embedded message is known as 'Stego- Message'. In the receiver side the receiver can extract the message by using the Message Retrieval Algorithm.

II.WORKING PRINCIPLE

2.1.Concept

As we are trying to send the code through music, we need these following parameters named **fs ,fpr , fop, Δ.**

2.1.1 fs:- (Synchronizing freq.): This is a very small frequency of several Hz. and the duration **ts**is also very small. After end of ts we will send a new frequency fpr.

2.1.2 fpr: (Pseudorandom freq.): The value of this freq. ranges between 50Hz-5000Hz.With our program we can generate any freq.. in between the prescribed range.

2.1.3 fop:-(Freq. used for mathematical operation.): This freq. has four defined values. Depending on the four values the program will make a decision that which of the four mathematical operations (addition, subtraction, division, and multiplication) should be done. Here we are using 250 Hz, 300Hz, 350Hz, and 400Hz for addition, subtraction, multiplication, division.

2.2 Implementation of the above concept:

We have proceed in such a way that three frequencies will be generated in a sequence- **fs, fpr ,fop** ; with a time delay Δ between them. After generation of these frequencies a time delay of **3Δ** is generated with an indication. Then the music embedded with the said frequencies and time delay will be transmitted. In between the music files we will insert our codes like this- Example: For sending 'A' we have defined 900Hz.We will take any instance of the music waveform and will do a mathematical operation depending on the value of fop with the value of fpr. For example: Let fpr= 500 Hz, fop=250Hz

Then the circuit will add the corresponding freq. of 'A' (900 Hz) with the freq. of that particular instance of the music to 500 Hz. In this way the circuit mixes the code with the music.

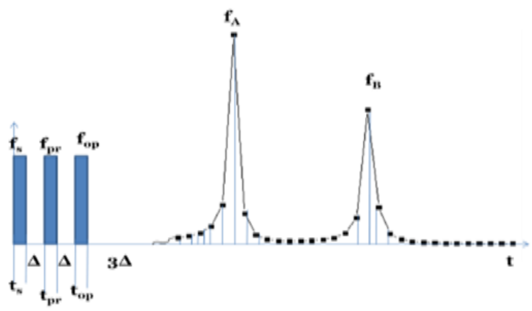

Figure 2: The above waveform shows two alphabets ('A'&'B') are embedded in a music file.

2.3 Software based PLL(SPLL):
Since we know that PLL is used to detect the freq. and phase of the output signal with input signal when it is locked. We have used Software PLL or SPLL in this project. However SPLL is used in the receiver side to detect and display the code alphabet (i.e to match corresponding frequencies) which is send through the music signal. In our next section the working principle of SPLL in this circuit is described by a flowchart.

2.3.1 Explanation:
In this session we are explaining the working of SPLL portion.

- Start the program.
- Grab the audio stream.
- Find the FFT of the audio stream.
- Show the audio stream output via spectrum analyzer.
- Find the power of the frequencies of every instance.
- If the power>Threshold power

then

- Compute the frequency distribution and duration.
- Check with given frequencies for 'A', 'B'….. 'Z', ' ', '.'
- If found then store the alphabets in a character array.
- Display the array.
- Back to start.

Else
Back to start.

III.SIMULATION RESULTS:

The programming is done in C# language in OPEN-CV platform. Which shows the output in a spectrum analyzer .Thenext 5 slides will show the output wave form of the square wave of 900Hz(A), 920Hz(B), 940Hz(C), 960Hz(D), 980Hz(D), 1000Hz(D) determined by the program. The music is analyzed by 'Goldwave' software.

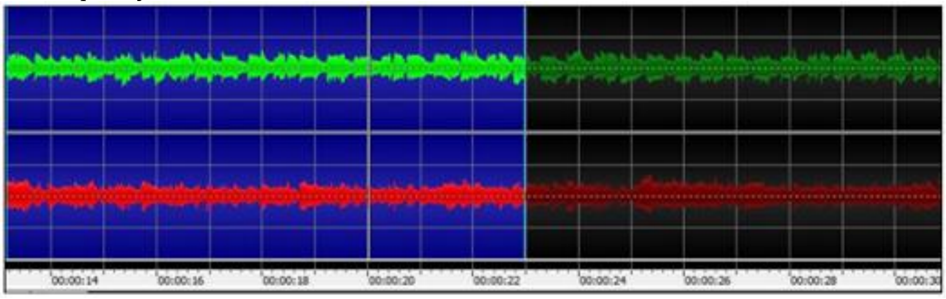

Figure3 : The waveform of a music file, taken by Goldwave software

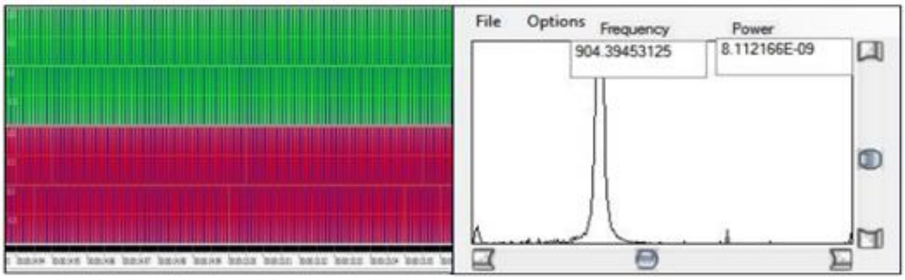

Figure4: Waveform of 900hz monotone(A) with frequency and power detected by PWM.

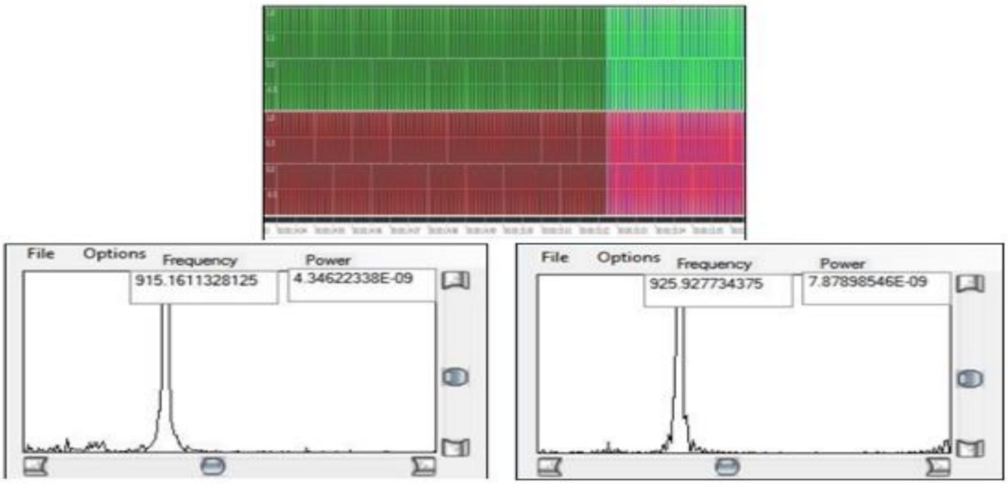

Figure4 : Waveform of 920Hz (B) monotone with frequency and power detected by PWM (Here the PWM is detecting multiple frequency and power)

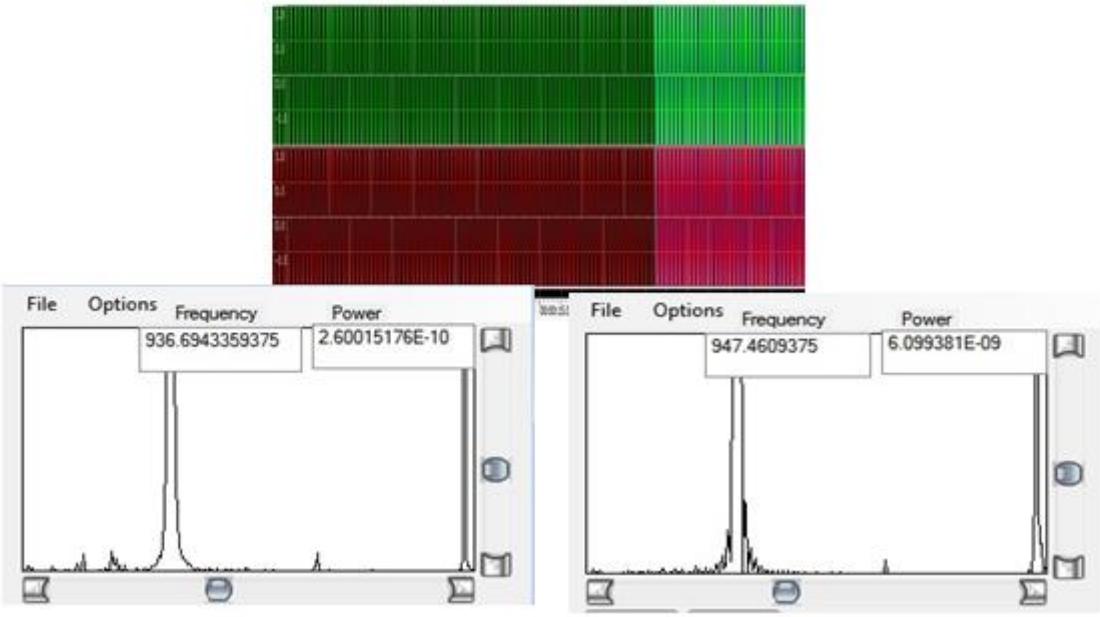

Figure5: Waveform of 920Hz (B) monotone with frequency and power detected by PWM (Here the PWM is detecting multiple frequency and power

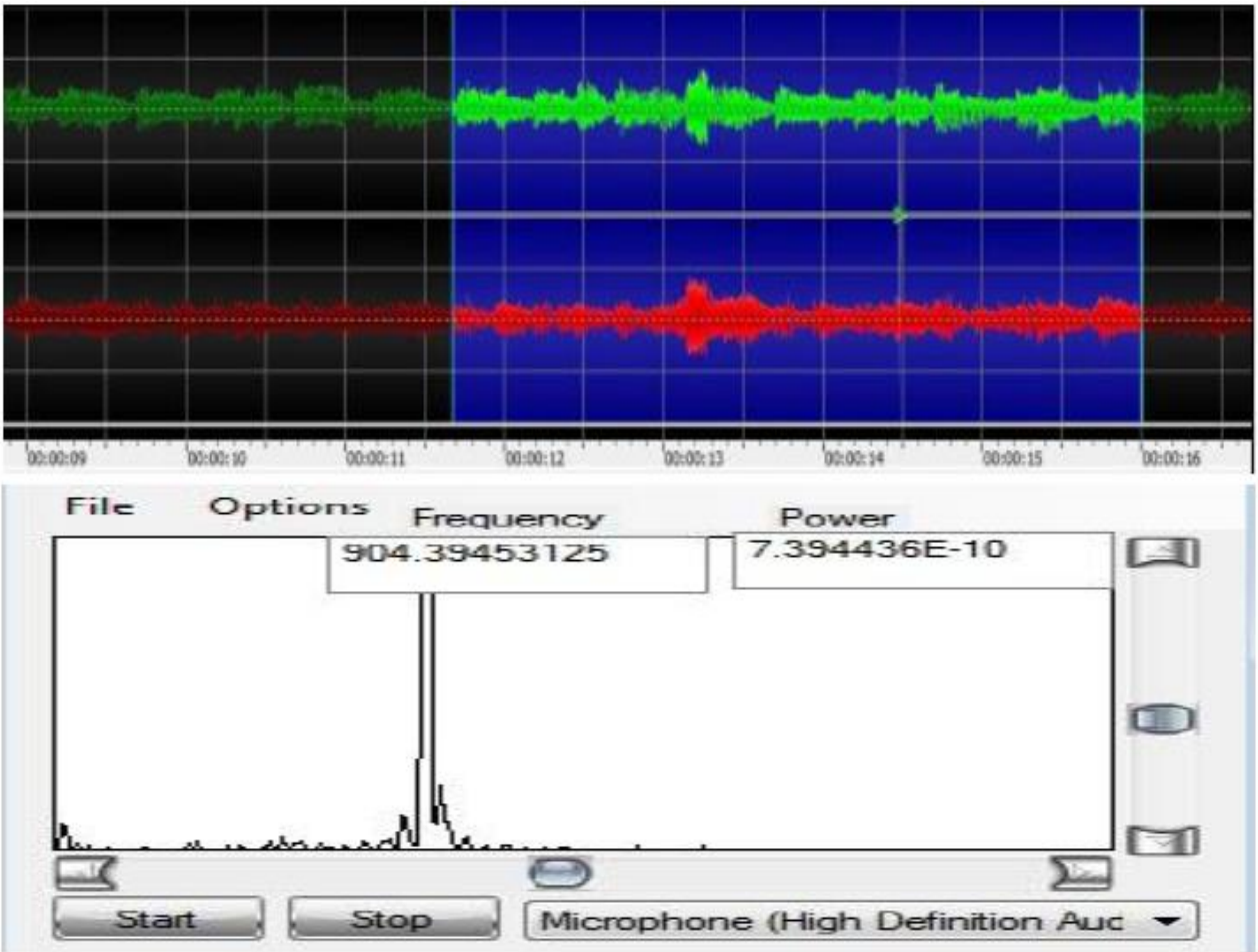

Figure 6 : a) Waveform of the output of 900Hz(A) with power -16 dB embedded in the music Signal b) Frequency and power of the mixed signal detected by PWM.

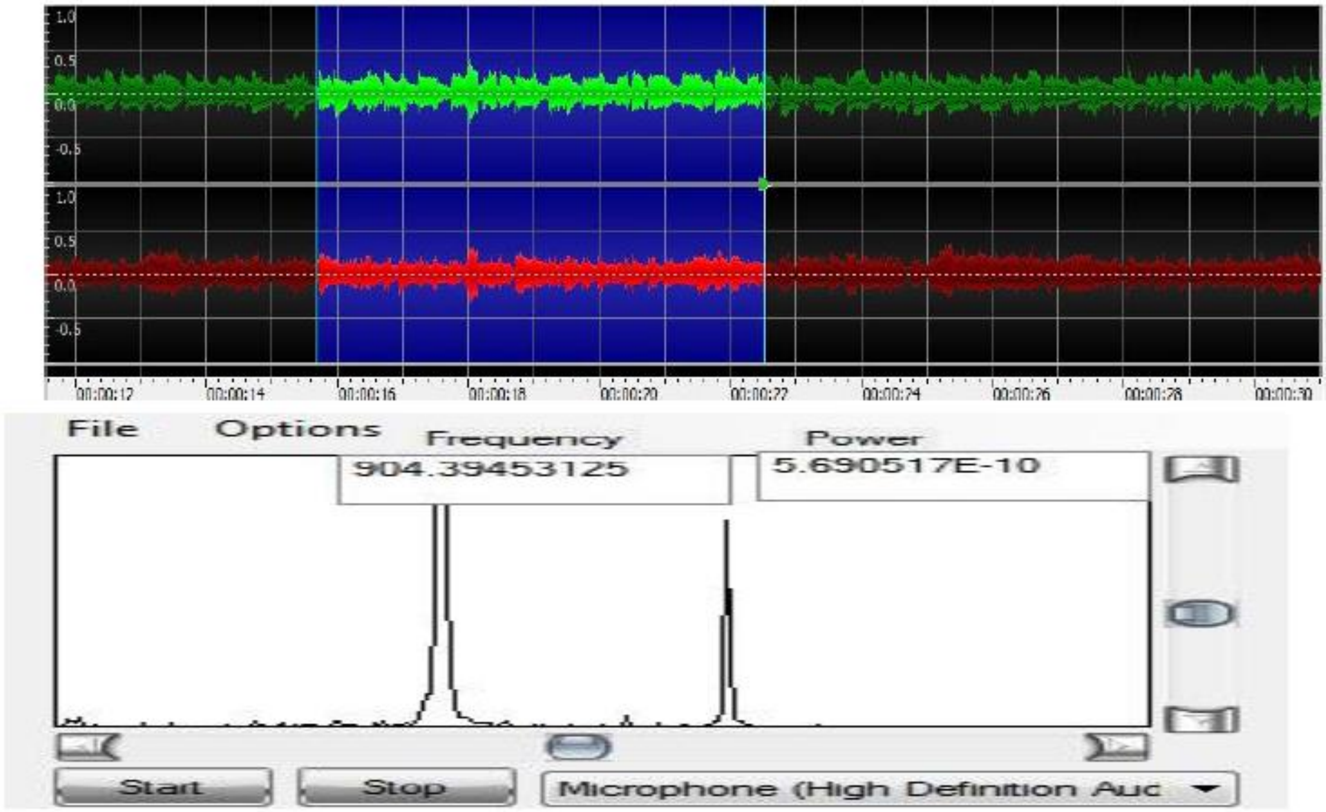

Figure 7: a)Waveform of the output of 900Hz(A) with power -17 dB embedded in the music signal b) Frequency and power of the mixed signal detected by PWM.

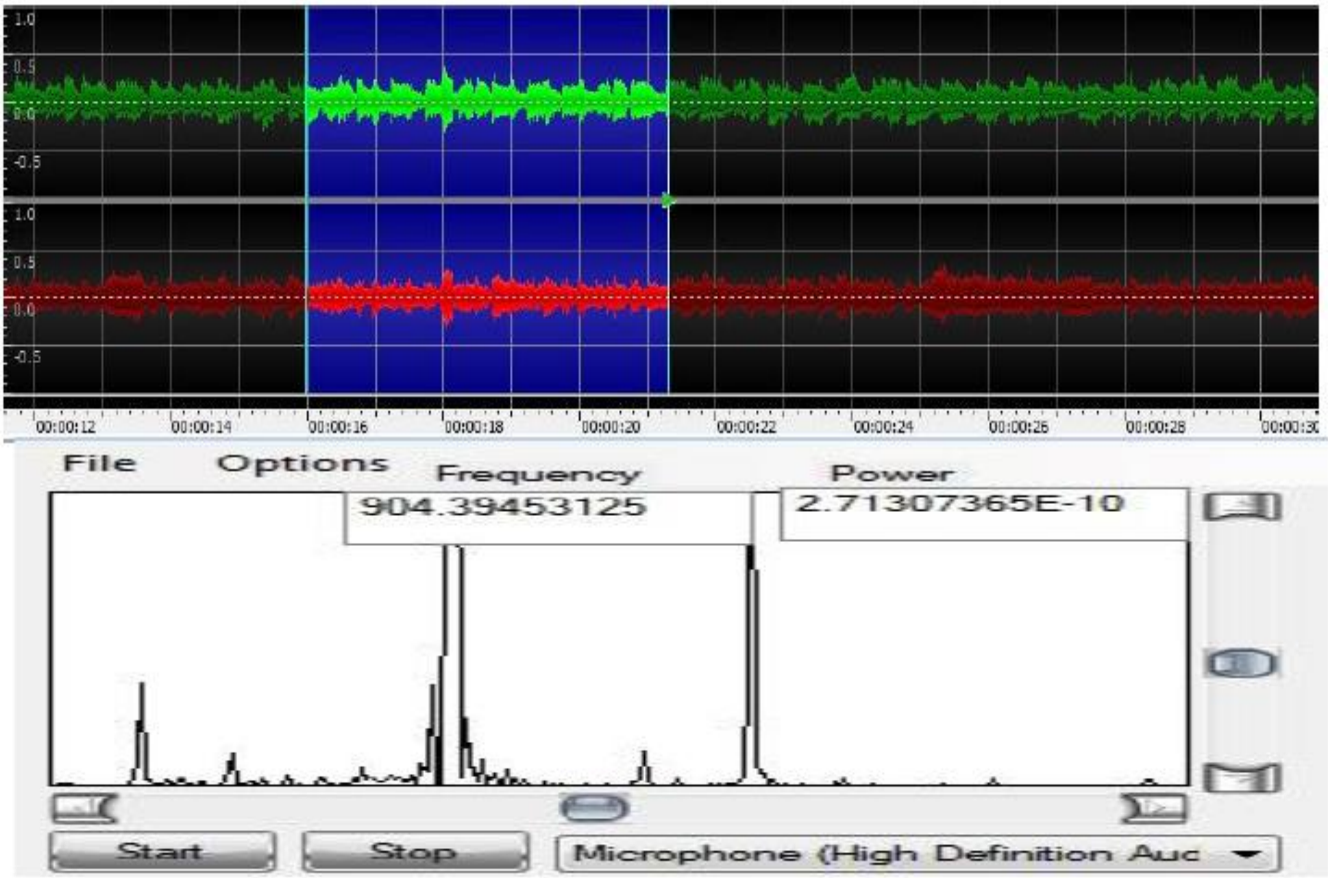

Figure 8: a) Waveform of the output of 900Hz(A) with power -18 dB embedded in the music signal b) Frequency and power of the mixed signal detected by PWM

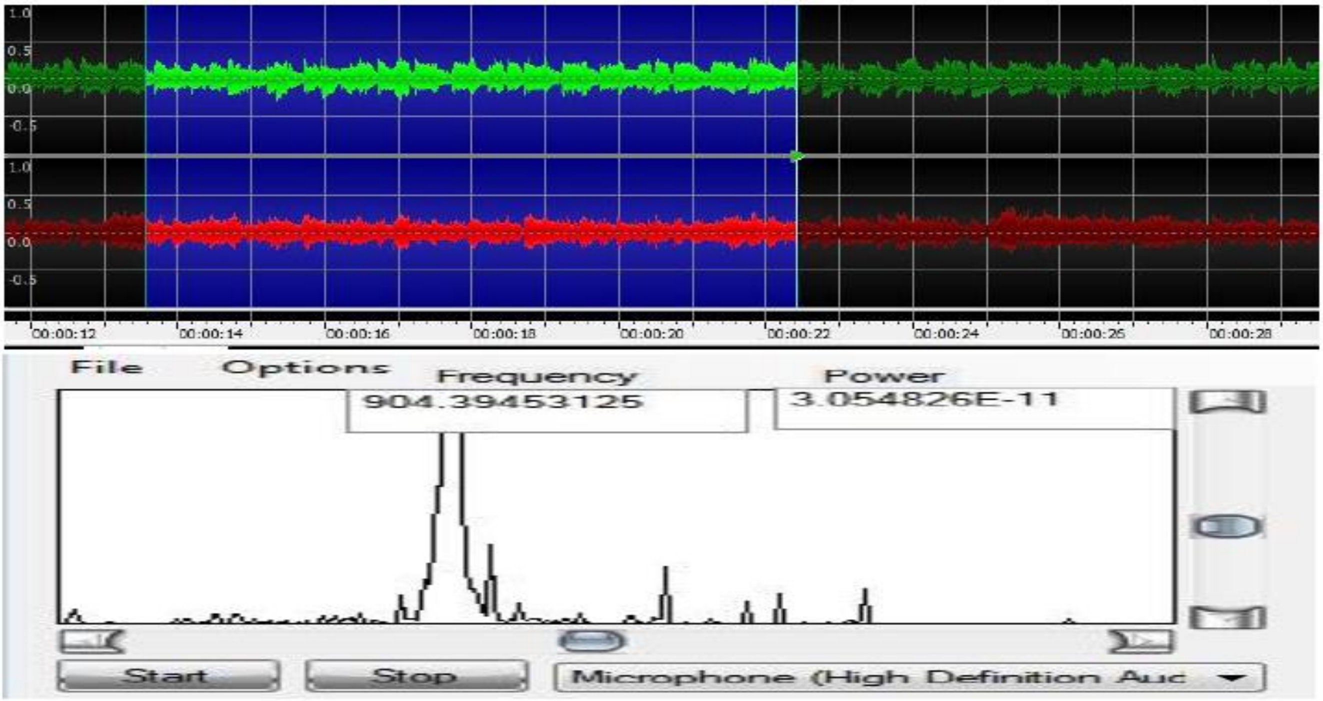

Figure 9: a)Waveform of the output of 900Hz(A) with power -18 dB embedded in the music signal b) Frequency and power of the mixed signal detected by PWM.

IV.CONCLUSIONS:

Since our entire work is based on software platform, we are trying to make a compatible microcontroller based hardware circuit to implement this concept. In the simulations discussed so far we can observe that there are some drawbacks-

- It is often detecting multiple frequencies. As an example for alphabets 'B'(920Hz) & 'C'(940Hz) we are getting (915,920)Hz& (936 & 947)Hz approximately.
- We are not getting exact value of the broadcasting frequency of the corresponding alphabets. As an example for alphabets for 'A'(900Hz) & 'D' (960Hz) we are getting 904Hz and 958Hz.

For small scale measurement FFT is sufficient to get good results. Here a music file of very short duration i.e. for a small window can be easily determined by FFT. But for a when the file is too large we are getting some distortions as explained previously. For this reason we need to apply 'Wavelet Transform' instead of FFT.

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