# Study of Different LSB Audio Steganography

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**Abstract – Audio steganography is the method of hiding secret information in an audio file. The audio file in which the secret information is hidden is known as audio cover. The sender embeds the secret message in the audio cover file using a key to produce a stego-file. At the receiver end, the receiver processes the received stego-file and extract the hidden message. In this paper study of different types of audio LSB steganographic methods are done.**

**Index Terms – Audio cover, Stego-file, Bit selection mapping, Sample selection mapping.**

## 1. INTRODUCTION

In audio steganography an audio or text is used as the secret message.Audio steganography has to be performed in such a way that stego message and the cover audio before steganography remains the same.Audio steganography is more difficult to perform as human auditory system is more sensitive than human visual system.

The rest of the paper is organized as follows. Different LSB audio steganographic methods are presented in Section II and section III concludes this paper.

## 2. DIFFERENT LSB AUDIO STEGANOGRAPHIC METHODS

### 2.1. LSB Audio Steganographic Approach

This is the simplest audio steganography approach and is suitable for any type of file format. Audio cover is sampled and converted into bit pattern. Each message character is converted into its equivalent binary form. LSB of each sample of the audio cover is replaced with the equivalent binary of each character of the secret message. Length of the secret message should be smaller than the total number of cover audio samples. Low complexity and easy implementation are the main advantages of this method. There are two main disadvantages associated with this method. First disadvantage is that human ear is very sensitive and can often detect even the slightest bit of noise introduced into a sound file. Second disadvantage is that this is not robust. If a sound file embedded with a secret message using LSB coding was resampled, the embedded information would be lost [1].

### 2.2. An Enhanced Least Significant Bit Modification Technique for Audio Steganography

Cover audio is sampled with each sample contains 8 bits. First, second and third LSB of cover audio can be changed without any noise. The secret message should always be within this three LSB's. 2 Techniques used in enhanced LSB modification are Bit selection mapping and Sample selection mapping.

Apart from this, the secret message is encrypted by AES-256 to make the relationship between plaintext and cipher text more complex.

Bit Selection Mapping

This algorithm can be modified according to the user. The secret message should be in the first 3 LSB's of the cover audio.

An example of the algorithm is shown below:

| *1st MSB* | *2nd MSB* | *Secret Message Bit* |
|---|---|---|
| 0 | 0 | 3rd LSB |
| 0 | 1 | 2nd LSB |
| 1 | 0 | 1st LSB |
| 1 | 1 | 1st LSB |

Table 1 Bit Selection Mapping

Sample Selection Mapping

Instead of using consecutive samples, samples are selected in a special manner to hide the secret message. This algorithm can be modified according to the designer. Table 2 is an example of sample selection mapping and i in the table denotes the present sample.

| *1st MSB* | *2nd MSB* | *3rd MSB* | *Sample containing next message* |
|---|---|---|---|
| 0 | 0 | 0 | i+1 |
| 0 | 0 | 1 | i+2 |
| 0 | 1 | 0 | i+3 |
| 0 | 1 | 1 | i+4 |
| 1 | 0 | 0 | i+5 |
| 1 | 0 | 1 | i+6 |
| 1 | 1 | 0 | i+7 |

| | | | |
|---|---|---|---|
| 1 | 1 | 1 | i+8 |

Table 2 Sample Selection Mapping

2.3 A Variant of LSB Steganography for Hiding Images in Audio

This is a modified form of LSB technology used for hiding image as the secret data in an audio cover. Grey scale image is normally used and each audio sample should consists of 16 bits. Image can be embedded according to the following algorithm[3].

Embedding Algorithm

1. Input the gray scale image convert it into binary form.

2. Read the cover audio file.

3. Start with the first audio data sample and first bit of the image.

4. Do the following:

a. Compare the image bit with the audio sample's 1st MSB to 7th MSB position till the first match is found.

b. If any MSB of audio sample matches with the image bit, replace the three LSBs of the audio sample with the binary equivalent of the MSB position.

else,

c. Insert all 0s into the three LSBs of the audio sample.

d. Move to the next audio sample.

5. Repeat steps 4a - 4d till the match for the image bit is found in some MSB of an audio sample.

6. Move to the next image bit.

7. Repeat steps 4 - 6 till all the image bits are successfully hidden into the audio file.

8.Write the wave audio file with stego-key that contains number of samples used to embed secret image in the audio file and number of rows/columns in the image.

9. Output wave audio file is the stego-object.

Extracting Algorithm

1.Read the stego-object i.e. Cover audio after encoding.

2. Extract the stego-key from the stego-object.

3. Do the following:

a. Select the audio samples one by one and extract the image bits from the MSB position.

b. If the value at three LSB positions is all 0s, move to next sample.

4. Repeat steps 3a – 3b till all the samples used to embed the image bits are used.

5. Store the image bits retrieved from the audio file into an array.

6. Divide the array into number of rows and columns and create the secret image.

7. Display the secret image.

## 3. CONCLUSION

The survey includes the works and findings done by various researchers on LSB audio steganography methods. The conventional LSB modification techniques are prone to steganalysis. Bit selection mapping and sample selection mapping increases robustness but decreases capacity. The method for hiding image is better than 3LSB and 4LSB insertion methods.

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