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AN OVERVIEW OF SECURE DATA HIDING AND EXTRACTION TECHNIQUES FROM DIGITAL CARRIER MEDIA

APARNA V. NAVLAKHA[1], DR. AVINASH D. GAWANDE[2]

1. Computer Science & Engineering Department, Sipna College of Engg. &Technology, Amravati, India.
2. Head of Comp. Sci & Engg. Department, Sipna College of Engg. & Technology, Amravati, India.

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Abstract: A new uncompressed Audio secure data hiding algorithm is proposed. This algorithm hides the secret messages (hidden text) within every day, seemingly innocuous objects (cover text) which is audio to produce a stego audio. The recipient of a stego audio can use his knowledge of the particular method of data hiding employed to recover the hidden secret message from the stego audio. The goal of information hiding is to permit parties to converse in such a way that an attacker cannot tell whether or not there's hidden meaning to their conversation. In the algorithm, embedding and detection operations are both executed entirely within the uncompressed domain, with no need for the decompression process. The new criteria using statistical invisibility of contiguous frames is used to adjust the embedding strategy and capability, which increases the security of proposed method. Therefore, the collusion resistant properties are obtained. Experimental results showed this method can be applied on decompressed Audio data hiding with high security properties.

Keywords: Higher LSB, Data Hiding, Extraction, PSNR, WAV Audio

Corresponding Author: MS. APARNA V. NAVLAKHA

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INTRODUCTION

In present situation, Data security is the major part of computer world and it's a rapidly growing area in IT sector. Data hiding is the transmission of a secret message hidden within an ordinary carrier while not revealing its existence. The cover file (container) may be a digital still image, audio file, or video. If we embed the secret message, then it can be transmitted across insecure lines or we can post in public places. For this reason, digital Audio is a convenient choice for data hiding. Nowadays, in modern information systems such as multimedia sensor networks, covert communications becomes a greater threat to forensic analysis than ever. Thus it is necessary to find out methods to discover and discourage covert communications such as data hiding in multimedia networks that acquire highly correlated data.

This method will focus on the particular problem of the compressed Audio data hiding. General speaking, digital Audio appears in two main distinct encoding formats: uncompressed and compressed. The most famous compressed format by far is motion compensated compressed Audio, specifically the widely accepted standard MPEGx. It accomplishes compression through the elimination of spatial, temporal and statistical redundancies and with this compression operation. The Audio bit-stream consist of variable length codes (VLC) that represent various Audio segments. For Audio stream usually being offered in compressed form, data hiding algorithms that are not applicable in compressed bit-stream will require complete or at least partial decompression. But this is an unnecessary burden which can be avoided. If the requirement of strict compressed domain data hiding is to be met, the data hiding needs to be embedded in the compressed domain. Method begins with replacing the higher bit of audio wave file called as carrier file. Sample of audio wave file are taken & 5th layer bit is replaced with the message bit, but care is taken for not having too much quantization error.

Recently, there are large amount of Audio watermarking algorithms been proposed where some of them are applied for compressed Audio. To be useful, a data hiding technique should not be easily detectable. If we can detect the presence of secret message with higher probability than random guessing, the corresponding data hiding technique is considered to be invalid. Similar to cryptography, data hiding may suffer from the attack method (steganalysis). Much of the research work for the field of steganalysis has been carried out on images. One approach is based soley on the blind steganalysis concept, which is produced by blind classifiers. The classifier should be trained to learn the differences between the features of cover and stego-image at first. Another approach is based on the first order statistics and is associated only with idempotent embedding

There are also two Audio steganalysis methods using collusion principle. And because of Audio statistical invisibility properties, inspired us to design this data hiding. In this paper, we propose a secure uncompressed Audio data hiding architecture taking account of Audio statistical invisibility. Also the architecture is with a steganalysis module, operated in a closed-loop manner to improve anti- steganalysis capability of stego Audio with data embedded.

- Literature survey and related work

Andreas Westfeld and Gritta Wolf [1], during this work authors have described a steganographic system which embeds secret messages into a Video stream. Normally the compression methods are used in Video for securing acceptable quality. But usually, compression techniques are lossy because reconstructed image may not be equal with the original. There are some drawback of compression and data embedding technique. Signal noise and irrelevance are common examples of data embedding. But compression methods try to remove noise of signal and irrelevance. If signal is compressed more, then there are fewer possibilities of data embedding. The authors have solved this problem, they have investigated a typical signal path for data embedding. In this method, security is established by indeterminism within the signal path.

Arup Kumar Bhaumik, Minkyu Choi, Rosslin J. Robles, and Maricel O. Balitanas[6], the main requirements of any data hiding system are security, capacity and robustness. It is very difficult to achieve all these factors together because these are inversely proportional to each other. Authors give focus on increasing security and capacity factor of data hiding. The data hiding method uses high resolution digital Audio as a cover signal. It provides the ability to hide a significant quality of information making it different from typical data hiding methods. They have used the large payloads like Audio in Audio and picture in Audio as a cover image.

Ahmed Ch. Shakir [7], the confidential communications over public networks can be done using digital media like text, images and audio on the internet. Simply hiding the contents of a message using cryptography was not adequate. Hiding of message provide an additional layer of security. To provide the more security the author suggested the new procedures in data hiding for hiding ciphered Information inside a digital colour bitmap image. He has used quadratic technique which depends on the locations concluded by the binary image, beside of public key cryptography. He had concluded that the conjunction between cryptography and data hiding produce immune information.

S.Suma Christal Mary [9], has proposed Real time Compressed Video Secure Steganography (CVSS) method using Video bit stream. In this, embedding and detection operations are both executed completely in the compressed. The proposed algorithm increases the safety because the statistical invisibility of contiguous frames helps to adjust the embedding strategy and capacity. At present we are hiding the data in audio format, so in the future implementation of uncompressed formats may possible as well. Multiple frames embedding are possible. Also we are embedding single frame at a time, but in future multiple frames embedding is also possible.

Saurabh Singh and Gaurav Agarwal [10], have presented a novel approach of hiding image in a Video. In this approach, one LSB of every pixel is replaced with one bit of secrete message. So it is very difficult to find that image is hidden in a Video of 30 frames per second. The analysis is very difficult because each row of image pixels are hidden in multiple frames of the Video. The intruder needs full video to unhide image. Authors have described the LSB algorithm in their paper. The proposed algorithm is very useful in sending sensitive information securely.

Sherly A. P. and Amritha P. P. [12], in their paper have proposed a new compressed video Steganographic scheme. In this scheme the data is hide in the compressed domain. The novel embedding technique Triway Pixel Value Differencing (TPVD) is used to enhance the capacity of the hidden secret information and for to providing an imperceptible stego-image for human vision. This method can be applied on compressed videos without degradation in visual quality.

Abdullah Bamatraf, Mohd. Najib Mohd. Salleh and Rosziati Ibrahim [13] in their work describes A New Digital Watermarking method using various combination of Least Significant Bit (LSB) and Inverse Bit. Author proposed a new LSB based digital watermarking method with the combination of LSB and inverse bit. The experimental result shows that the proposed algorithm maintains the quality of the watermarked image. When combining different positions of LSB such as the second LSB, third LSB and fourth LSB and the various combination between them. The proposed algorithm is also tested using Peak signal-to noise ratio (PSNR).

Yusuf Perwej, Firoj Parwej, Asif Perwej [14] in their work describes An Adaptive Watermarking Technique for the copyright of digital images and its protection. Authors proposing edge detection from Gabor Filter method, uses data hiding by the simple LSB substitution method. In the method a set of pixels that constitute a block jointly share the bits from the watermark .The values of mean square error (MSE) and peak signal to noise ratio (PSNR) are measured. The results shows that the method introduces low noise and hence ensures lesser visible distortions.

S.S.Verma, R.Gupta, G.Shrivastava [15] in their work presented a high capacity and high stego-signal quality audio steganography scheme based on the samples comparison in DWT domain where selected coefficient of a segment value is change by a threshold value depending on the embedding cipher text bit. The strength of their algorithm is depend on the segment size and their strength are enabled the algorithm to accomplish very high embedding capacity for different data type that can reach up to 25% from the input audio file.

- **PROPOSED METHODOLOGY**

A. Data Hiding in Audio Wave file

- One of the simplest algorithms with extremely high data rate of additional information is hiding the data inside the least significant bits (LSBs) of audio samples in the time domain. A given technique could shift the limit for transparent data hiding in audio in the fifth LSB layer, by using a two-step approach as shown in algorithm. Within the first step, a watermark bit is embedded by using a LSB coding method into the 5^{th} LSB layer of the host audio. In the next step, whatever the impulse noise generated by watermark embedding is shaped in order to alter its white noise properties. The original host audio bit in the 5^{th} layer replaces with the bit from the watermark bit stream by using standard LSB coding method. If the i^{th} LSB layer is used for embedding and the original and watermark bit are distinct then the error due to watermarking is 2^i-1 quantization steps (QS) (amplitude range is [-256 to 255]). If the original bit value is 0 and watermark bit value is 1 then the embedding error is positive and vice versa. The main idea of the proposed LSB algorithm that causes minimum embedding distortion of the host audio is watermark bit embedding. It is clear that, if only one of 8 bits in a sample is fixed and identical to the watermark bit, the other bits can be flipped in order to reduce the embedding error. For example, if the original sample value was $(00100000)_2=32_{10}$, and the watermark bit is one is to be embedded into 5th LSB layer, instead of value $(00110000)_2=48_{10}$, that would the standard algorithm produce, the proposed method produces sample that has value $(00011111)_2=31_{10}$, which is far more closer to the original sample. The extraction algorithm just reads the bit value from the predefined LSB layer of watermarked audio sample and retrieves the watermark bit . In the embedding algorithm, the 5th LSB layer is first modified by insertion of the present message bit and then the algorithm shown below is run. The case in which the bit a_i need not be modified at all, no action is taken with that signal sample. Underlined bits (a_i) stands for bits of watermarked audio.

- *Procedure*

1. First of all select carrier wave file. Payload is directly proportional to the carrier file size.
2. Then select a key file which may be any file like .txt, .PDF,.doc,.exe, .rar, .zip, .html etc. length of key file should be less than carrier file.
3. Select data and encrypt it using symmetric key cryptography.
4. Hide the data in a carrier file.

- Select a random sample of carrier file based on the content of key file.
- Select a file for hiding which may be of any type like.bmp,.txt etc.
- Replace the 5th bit of audio carrier file with the message bit and then flipped the other bits of carrier file to reduce quantization error.
- Save the resultant wave file.

5. Read the message bit from resultant file. Too many questions are arises that are how we can select sample from carrier file & how to replace 5th layer layer bit will cause the different quantization error and that error will depend on the sample value. This is true & that why the other bits of the samples are flipped so as to minimize the quantization error.
6. The figure - 1 given below shows the way that how the concept works and different terms used for the process of data hiding are

- Carrier /Cover File :- A original message or a file in which hidden information will be stored in it
- Stego – Medium :- The medium in which information is hidden
- Embedded or Payload :- Information which is to be concealed
- Steganalysis:- The process of detecting hidden information inside a file.

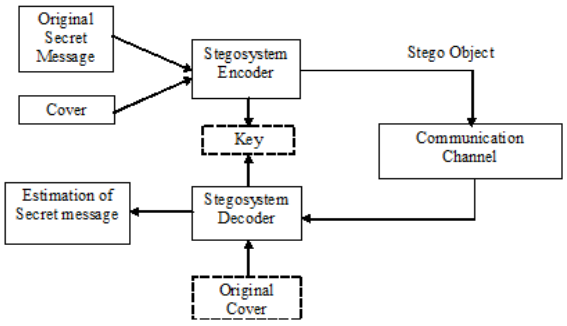

Fig-1 Fundamental procedure of data hiding

In the above diagram the secret message can be any text file or image or any audio wave file and then inputting the cover signal in which data is to be embedded. The cover signal must be sufficient large to cover the message. After selecting the input secret message and cover signal next, we find the length of the audio file as well as length of the text file. Before hiding the secret message into cover signal it must be converted into the other form so that it can't be interpretable by intruder. Before delivery of the secret message to receiver, it must be converted back to its original form.

C. 5th Bit LSB Replacement Algorithm

if 5th LSB!= Data Bit

if bit 0 is to be embedded

if $a_{i-1} = 0$ then $a_{i-1}, a_{i-2}, \ldots\ldots, a_0 = 11\ldots\ldots1$

if $a_{i-1} = 1$ then $a_{i-1}, a_{i-2}, \ldots\ldots, a_0 = 00\ldots\ldots0$ and

If $a_{i+1} = 0$ then $a_{i+1} = 1$

else if $a_{i+2} = 0$ then $a_{i+2} = 1$

.....

else if $a_7 = 0$ then $a_7 = 1$

else if bit 1 is to be embedded

if $a_{i-1} = 1$ then $a_{i-1}, a_{i-2}, \ldots\ldots, a_0 = 00\ldots\ldots0$

if $a_{i-1} = 01$ then $a_{i-1}, a_{i-2}, \ldots\ldots, a_0 = 11\ldots\ldots1$ and

If $a_{i+1} = 1$ then $a_{i+1} = 0$

else if $a_{i+2} = 1$ then $a_{i+2} = 0$

.....

else if $a_7 = 1$ then $a_7 = 0$

This algorithm hides the secret messages, seemingly innocuous objects (cover text) which is audio to produce a stego audio. The block diagram of message hiding algorithm at sender is shown in fig-2.

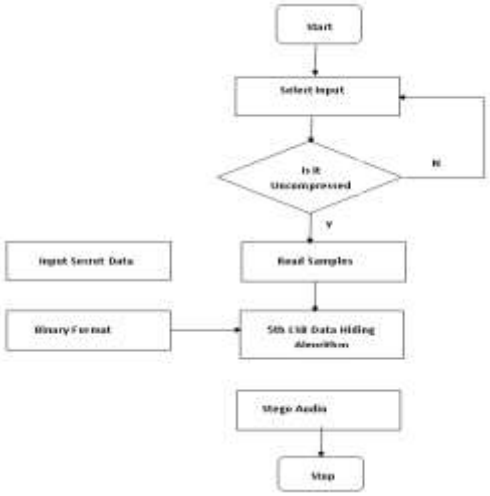

Fig-2 Flow chart of message hiding at sender side

Then the recipient of a stego audio can use his knowledge of the particular method of data hiding employed to recover the original secret message from the stego audio. The block diagram of message recovery algorithm at receiver side are shown in fig- 3.

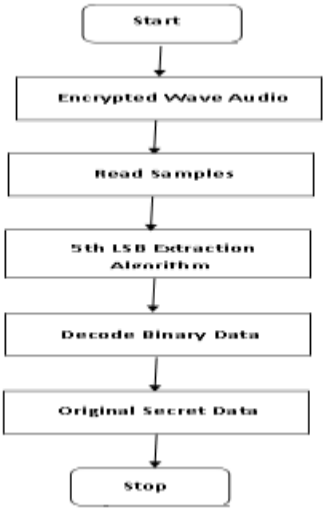

Fig-3 Flow chart of message recovery at receiver side

- APPLICATION

- Data hiding using audio can be used anytime you want to hide data. There are number of reasons to hide data but most important is to avoid unauthorized persons from becoming aware of the existence of a message.

- Provides better security for secret data sharing in LAN, WAN, MAN

- Complements regular encryption

– How will someone decrypt your message if they will unable to discover it?

– Difficult to break: require to find the cipher text first, then it needs to be decrypted

- Used in military and police communications

- Digital Rights Management – protecting intellectual property such as images, music, electronic books, etc.

- Tamper proofing – ensuring a data file has not been changed

- Communicating in an oppressive country w/o free speech i.e. confidential communication and secret data storing.

- **CONCLUSION**

An application that require high-volume embedding with robustness against certain statistical attacks, the proposed method has been used. The requirements of a good data hiding algorithm is identified by the present method try to identify. The data hiding method assumes that if the feature is visible, the point of attack is evident, thus the goal here is always to hide the presence of the embedded data. Only data hiding is neither a good solution to secrecy, nor an encryption. But if we combined both of these methods, it will provide two layers of protection. If the message is first encrypted and after that hide with a LSB data hiding method then the embedding capacity increases and in this way we can hide large volume of data. Hence the resultant technique satisfies the necessities such as capacity, security and robustness which are intended for data hiding. So we can transmit resulting stego-audio without revealing that secret information is being exchanged. Suppose if an attacker tries to defeat the data hiding technique to detect the message from the stego-object, he would need the cryptographic

decoding key to decipher the encrypted message. The proposed algorithm is analyzed using statistical framework to show its level of security and also to prove its efficiency.

The main focus of the proposed method is to develop a system with extra security features where a secret message can be hidden by data hiding techniques. That means this system produce a decent, economical technique for concealing the information from hackers and sent it to the destination in an exceedingly safe manner. So it are often all over that Higher LSB and bit undulation in planned technique are often used which is able to bring numerous blessings which might be used for variety of functions aside from coated communication. The presents a theme that may transmit giant quantities of secret info and supply secure communication between two communication parties.

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