A Review of Steganography Research and Development

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Abstract: Providing confidential information and establishing concealed association has been a great interest since long time ago. So, there are a lot of methods which are widely used. This paper provides a review to the various steganography techniques. Steganography is the art and science of hiding a secret message in a cover media such as image, text, signals or sound in such a way that no one, except the intended recipient knows the existence of the data. The future research in the field of Steganography is briefly studied.

Keywords: cryptography, steganography, data hiding, stego image, symmetric and public key cryptography.

I.   INTRODUCTION

In today's information technology era, the internet is an essential part for communication and information sharing. Due to the expeditious development in Information Technology and the Internet, the security of the data and the information has raise concerned. Every day, confidential data has been compromised and unauthorized access of data has crossed the limits. Great measures should be taken to protect the data and information [1, 2]. Steganography combined with encryption will be a powerful and efficient tool that provides high level of security [3].

A. Cryptography: is the practice and study of techniques for secure communication in the presence of third parties. The modern field of cryptography can be divided in to two ways: Symmetric key cryptography and public key cryptography. The symmetric key cryptography provides encryption of data at the sender and the receiver side where both share the same key. The symmetric key cryptography is implemented via block ciphers or stream ciphers. This form of cryptography has a disadvantage that it involves the key management process for the secure networking. The number of keys required increases as the square of the number of network members, which very quickly requires complex key management schemes to keep them all consistent and secret .To solve the said issue , the public key cryptography came in to existence. In public key cryptography , the encryption is done through public key(which is available to all) and the secret key often referred to as private key is used to perform the decryption process. The pairing of public and private key ensures secure communication. This technology can be used to implement digital signatures scheme.
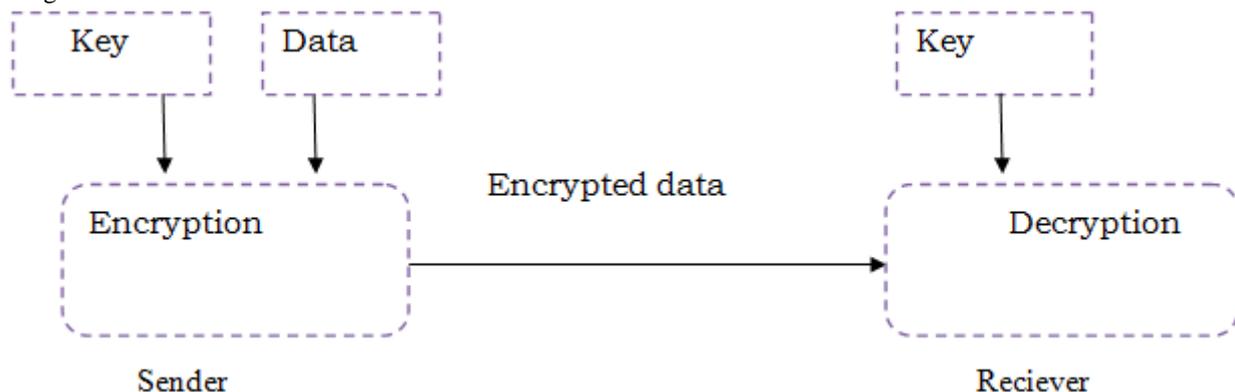

Fig 1: Cryptographic Technique

B. Steganography: is the art or practice of concealing a file, message, image, or video within another file, message, image, or video. The advantage of steganography over cryptography alone is that the intended secret message does not attract attention to itself as an object of scrutiny. Plainly visible encrypted messages no matter how unbreakable will arouse interest, and may in themselves be incriminating in countries where encryption is illegal[4]. Thus, whereas cryptography is the practice of protecting the contents of a message alone, steganography is concerned with concealing the fact that a secret message is being sent, as well as concealing the contents of the message. The primary objective of steganography is to avoid drawing attention to the transmission of hidden information. If suspicion is raised, then this objective that has been planned to achieve the security of the secret message because if the hackers noted any change in the sent message then this observer will try to know the hidden information inside the message.[5][6].

II.   REVIEW OF RESEARCH AND DEVELOPMENT IN STEGANOGRAPHY
A.   Table 1 : A Review of Research on Steganography
Table 1: Illustrates the review of steganography Research and Development

S. No.	Title	Year	Country	Keyword	Summary
1	Image steganography using Block complexity analysis [7]	2012	India	steganography ;capacity-quality trading–off interrelation	This paper provides the concept of block complexity analysis that embeds the secret message in the original image. This algorithm works on wavelet transform coefficients to embed the secret data. The capacity quality trading off interrelation is also explained in this paper.
2	Efficient data hiding scheme using lossless Data compression and image steganography. [8]	2012	India	Steganography, Compression, Peak Signal to Noise ratio, Mean Square Error.	This paper proposed a data hiding scheme which is based on the compression and image steganography. This technique retains the quality of the image and also uses a lossless data compression technique.
3	A Security Enhanced Robust Steganography Algorithm for Data Hiding [9]	2012	India	Steganography, Data hiding, DCT, Chaotic Sequence, Arnold transforms.	This paper proposed a new secure and robust algorithm that is based on the Discrete Cosine Transform, Arnold Transform and chaotic system. The authors have also demonstrated that the proposed algorithm is more robust and secure than the JPEG compression and cropping attacks.
4	A secure and high capacity image Steganography technique[10]	2013	India	Steganography, IWT, MSE, PSNR, RGB, Luminance, Chrominance	This paper provides a steganography technique to conceal multiple secret images and keys in a color image using IWT. Extremely good Peak Signal to noise Ratio values are obtained for both the stego image and extracted secret image
5	A New Approach to Hide Text in Images Using Steganography [11]	2013	India	Steganography, cryptography, secret key, LSB, embedding, extraction	This paper proposed a new steganography algorithm that hides the text file inside an image. This paper also proposes a compression algorithm.
6	Analysis of Random Bit Image Steganography Techniques [12]	2013	India	LSB Steganography, intensity value of a pixel, physical location of a pixel.	This paper proposes image steganography techniques which are based on the spatial domain. Authors have used various steganography techniques like LSB, layout management schemes for hiding secret message in an image. Various parameters of image like pixel, intensity value of pixel are also detailed in the paper.
7	A new image steganography technique based on similarity in secret message [13]	2013	India	steganography; pattern clustering; image colour analysis; data analysis; image processing	This paper proposes a new image steganography scheme for colored images based on the concept of the cluster analysis. Authors have also compared their results of proposed method with the modified Kekre algorithm.
8	A Survey on Audio Steganography Techniques for Digital Data Security[14]	2014	India	cryptography, steganography, audio steganography, LSB, watermarking	This paper proposes a comparison and evaluation of digital data security techniques.
9	Highly randomized image steganography using secret keys	2014	India	Cover Image Image Steganography	This paper proposes an image steganography that uses two secret keys to randomize the bit hiding process. Author

	[15]			Randomized Steganography Secret Keys Steganography Stego Image	used PSNR value to determine the quality of stego image and has also provided comparison with other image steganography techniques.
10	An efficient filtering based approach improving LSB image steganography using status bit along with AES cryptography [16]	2014	Bangladesh	AES Cryptography Conceal of Message Filtering Algorithm Image Steganography LSB Image Steganography	This paper proposes the use of bitmap images to implement the LSB Steganography method. Author has also made use of AES algorithm to enhance the security. The paper also describes the disadvantages offered by the traditional LSB approach

The table described above can be explained as:

1. The first research paper, image steganography using block complexity analysis, proposed an algorithm that works on the wavelet transforms coefficients, which embedded the secret data in to the original image. The second Research paper proposed a data hiding scheme that can hide the gray image as well as the color image using image steganography and compression. The third paper proposed an algorithm that uses three concepts i.e. Discrete Cosine Transform, Arnold Transform and chaotic systems.

2. In 2013, there are four researches being reviewed, the first research proposes an image steganography technique that hide multiple secret key and image by using Integer wavelet transform technique. In one color image, two secret images can be hidden. The approach produces a high quality stego image that has very high peak to signal ratio as compared with the other techniques. The second research proposes an algorithm, which is an extension of LSB; the proposed algorithm hides the data in the LSB of the RGB components of the pixel. The paper also describes the comparison of different file sizes in formats of an image. The third research proposes a steganography technique based on spatial domain. The paper also provides an analysis of steganography methods with the help of various analysis tools. The fourth research analysis the secret data to make its clusters. The clusters is described with an ASCII value if the secret data is textual , is sample value if the secret data is audio or speech and is taken pixel value if the secret data is an image or video.

3. In 2014, there are three researches being reviewed, the first research is the survey of various audio steganography techniques, which is described by the comparison of various data security techniques followed by the comparison of various steganography techniques. The second research presents a different image steganography technique that takes two secret keys to randomize the bit hiding process. The paper proposes that the use of two secret keys will maintain the high data hiding capacity. The third research focuses on bitmap image format to implement LSB steganography method. The paper also proposes the use of AES algorithm to ensure two layer security of the message.

4. From the three consecutive years (2012-2014), the most preferred choice of the researchers is image Steganography techniques. There are four main categories that used in steganography that are image, audio, sound and protocol [17]. Out of ten researchers, seven is proposing new techniques or methods in image steganography. Image files usually are comply with the requirements of creating a stego image but researchers are also focussing on other methods like audio, video, etc to hide the secret data.

III. FUTURE SCOPE

In this modern era of technology, with the increase in the need of secure and robust communication, the Information and technology sector looks towards the future research in the field of Steganography, as cryptography alone cannot provide a secure communication. Some future researches may include:

1. Developing a system by combining the benefits of both cryptography and steganography
2. Developing an environment which should be platform independent.
3. Considering different media other than images, video i.e. the traditional media
4. Use of best algorithms to achieve a secure and a robust communication.

IV. CONCLUSION

The paper presented above gives a understanding of cryptography and steganography concepts, along with it the paper gives a review of the research and developments in the field of steganography through the various steganography techniques. The paper also provides the suggestion regarding the future researches in the field of steganography.

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