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Data Hiding Using Arnold Transform Bit Shift Method

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ABSTRACT
Computer security, for a long period of time, it was mainly a limited field for study and was studied by the computer scientists, electrical engineers. The methods of data hiding have taken an important role with the growth of fast transfer of multimedia content and secret communications. There are different different methods which are used for data hiding and one of them is Steganography. Steganography is the way of hiding information in such a method to prevent the detection. There exists a large variety of Steganography methods for hiding secret information in pictures, some of them are more complicated than others. They have both strong point and weak point . This algorithm will not be in the favour of Noise, and Contrast Attacks etc. In this paper a picture is encrypted and then hiding the picture into any other gray picture file engage Least Significant Bit (LSB) based Steganography and Arnold's transformation algorithm based Cryptography. The result of this experiment shows that the algorithm has good security and intangible or invisible in gray scale pictures .There are some general terms which are becoming an important area in the field of steganography and these general terms are Digital Picture Processing, Security Keywords, Picture processing Steganography, information hiding .As the demand of privacy and security increases, requirement for hiding their secret information is also increasing. If one person wants to send their secret information to other persons securely, then he can send it by applying picture steganography., A new suitable and efficient picture encryption method is presented in this paper. It basically uses a combination of least significant bit (LSB) and Arnold's cat map algorithms. The main objective of this algorithm is that to achieve a better security than the existing ones.Digital picture steganography has several applications in information security and communication. Data hiding in encrypted pictures is confirming that the cover picture and the secret message can be recovered at receiver side. This paper task presents a data hiding and picture encryption scheme engaging unsymmetric diffusion and Two dimensional Arnold cat mapping transform. In the least significant bit positions of the cover picture the secret message bits are placed .In the random diffusion step,a random 8 bit random integer stream is generated using a shared key and then added to steganography picture. To disorganize the pixels Arnold cat mapping transformation is done. To completely encrypt the picture contents, Substitutely several times the two steps of random diffusion and Arnold transform mapping are done. On the receiver end the process is reversed to get both the secret message and the cover picture with little loss. The limited time of Arnold transform is overcomes by the diffusion step . One bit per pixel embedding volume is attained . Security analysis is done which shows that the encryption is highly safe. From preventing brute force attacks the number of collision is low. With minimal losses the original picture is recaptureable. Steganography is a trustable tool that is used to achieve the top-secret communication. Till the present time the available methods hide the secret data over the picture on a fixed type of pattern which makes a user to identify the pattern easily. For detecting the skin area from the picture we will perform some biometric operation by using the proposed approach. Edge detection is performed after detecting the skin area. we will use this area as a pattern to hide the data over the picture after detecting the edge. After that the secret data is compressed doing the DWT method after that the additional compressed is done when top-secret info is encrypted using RSA algorithm with bit shift method. This proposed method gives more security to our data. Because of this the picture distortion of the carrier picture is low and it is very difficult to identify the Secret picture.
Keywords: Arnold's cat map, Least significant bit (LSB), picture hiding.

I.INTRODUCTION

Steganography is the technique for hiding the certainty that communication is going on or taking place. It is capable of hiding one information in another information. It is a technique of secrete a message in a cover without leaving an exceptional area on the original message. The main goal of Steganography is to hide the presence of communication making the true message imperceptible to the observer. Steganography is of given types and these types are mentioned below

1. Audio 2. Picture 3. Text 4. Video

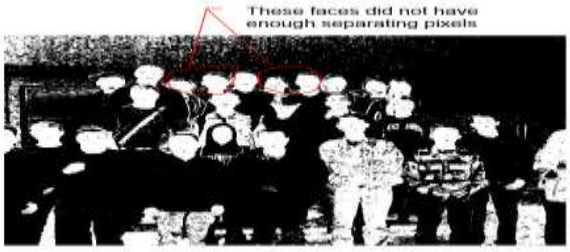
From protecting it to the unauthorized access the process of hiding the secret data into a cover object is used. It is a method which hides the existence of the message called as invisible communication. The picture steganography is defined as that when the cover object used is an picture. It has a lots of applications like online transactions, military communication, etc. The method of engaging a secret picture into another picture is called as picture hiding. The mixture of the secret picture and the cover picture is called as the stego-picture. Existence of the secret Picture in the final picture will be invisible by using the picture hiding methods by an unpremeditated observer, so that it can be relocated diligently[1].

By using [1] it was mentioned that "Security through intricacy tells that you will be secure if you hide the inner workings of your system. This method does not work when it comes to security, and when it comes to cryptography it does not work". sometimes in combination with other methods are the requirements of secret communication, such as cryptography, and Steganography, companion each other. To obtain a higher security it is suggested to use these two methods together. Information security is the protection of information. To prevent the unauthorized use of data or capabilities some defined methods are used [2]. Picture disorder make some transform, which makes the particular location of the pixel become chaotic, and drop their original properties. To achieve the encryption the total number of pixels and histogram has not unchanged. In addition, the disorder must be one kind of reversible change; otherwise it will not have any essential in the

practical application. It is impossible to retrieve the original picture , if someone don't know the rules of the transformation. When the process of disorder is going on, the loss of the hidden information is also distributed into the complete hidden data, where it reduces the loss of necessary information so as to attain the improving robustness. The technology of picture scrambling is widely used in the picture Steganography area [3].One of the picture scrambling method is Arnold transform. The transformation shifts pixel position from (x, y) to (x', y') without affecting its gray value. The secret picture repeats itself after a certain number of repetition because it is cyclic. . It is a technique of secrete a message in a cover without leaving an exceptional area on the original message. The main goal of Steganography is to hide the presence of communication making the true message imperceptible to the observer.

The secret message is hidden into a cover object ,it is the basic steganography process. The cover object can be any one of them either a text, an picture, an audio file or a video clip. There a secret key is also used and by employing the secret key the secret message is placed into the cover object. This new obtained message is called stenography message. Over the public channel the steganography message is transmitted. On which message the steganography is applied from there the receiver gets the retrieves and key is same as used by the sender. By hiding the existence of the message the security is achieved.

The remaining paper is organized in such a way: section 2 gives an brief about the proposed work. Sec. 3 gives the details of the implementation of an picture hiding method. Sec 4 shows the execution of an Arnold cat map transformation. Section 5 contains Results and analysis . Finally section 6 gives the conclusion.



The mixture of the secret picture and the cover picture is called as the stego-picture. Existence of the secret Picture in the final picture will be invisible by using the picture hiding methods by an unpremeditated observer, so that it can be relocated diligently.

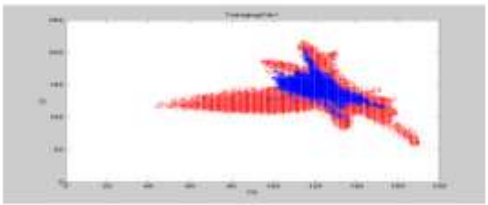


Figure Skin Data (blue) vs. background data (red) in YCbCr color space. A lot of the background pixels (red) occupy the same space as the skin pixels (blue).

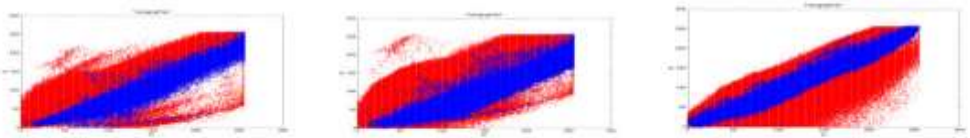


Figure : Skin Data (blue) vs. background data (red) in RGB color space. A lot of the background pixels occupy the same space as the skin pixels.

As we saw from the previous plots that the YCbCr and the RGB color space versus the HSV space has less non-skin pixels overlapping with skin pixels. The Radiance information from the color information doesn't differentiated by the RGB space colour . It was perceived that the color of the picture background contents, such as floors, building is similar to skin color. To get rid of the skin color-like pixels because they excessively fall between H values of 0.1 and 0.2, while most skin pixels are less than 0.1 in the HSV space it is very appropriate.

1.1 Connected Component Analysis Analysis A Binary Mask with the same size of the original picture is created by the color segmentation. The Binary Mask generated from the training picture no. 5 is shown as example in figure 3(1)

includes many of the skin regions like faces,arms, hands etc. However, skin also appear white with some similar regions: pseudo-skin pixels like floors and buildings.

1.2 Basic steganography process, The secret message is hidden into a cover object ,it is the basic steganography process. The cover object can be any one of them either a text, an picture, an audio file or a video clip. There a secret key is also used and by employing the secret key the secret message is placed into the cover object. This new obtained message is called stenography message. Over the public channel the steganography message is transmitted. On which message the steganography is applied from there the receiver gets the retrieves and key is same as used by the sender. By hiding the existence of the message the security is achieved. The remaining paper is organized in such a way: section 2 gives an brief about the proposed work. Sec. 3 gives the details of the implementation of an picture hiding method. Sec 4 shows the execution of an Arnold cat map transformation. Section 5 contains Results and analysis . Finally section 6 gives the conclusion.There is also a great field of interest and that field is named as Human face detection by computer systems. In a wide range of application Face detection algorithms are used and these applications areas are security control, biometric signal processing, human computer interface, face recognitions etc. However, to develop a complete robust face detector is difficult due to various light conditions, background, face sizes, and skin colors. In this report, we propose a face detection method for color pictures. And these methods checks skin regions over the complete picture, and then creates face candidates based on a connected component examine. Finally, by an enhanced version of the matching method face candidates are divided into human face and non-face pictures. Over the EE368 training pictures experimental results shows successfull face detection.

1.3 Goal of the Connected Component algorithm is to examine the connection property of skin regions and check out the face candidates which will be showed by rectangular boxes. However in some situations, two or three faces are connected by ears or high radiance hairs. With it pseudo-skin pixels are dispersed and create hundreds of connected components, which cost not need computations if they are found as face candidates. Therefore, before connected component analysis is done, preprocessing of the binary mask is necessary. Two faces that are connected are shown in Figure 3(2). However, in comparison with the the inside regions of the face the connection is thin and it can be shattered by picture morphology operations. In particularly, to erode more pixels in column directions, one row direction and one column direction picture erosion operations are applied. This is based on the discern that faces are typically connected more horizontal. Connections between the parts above and below the eyes are brittle within a face, and it is assumed not to erode this connection. An important role is played by the light condition of the picture for the quality of the binary masks. In strong light condition, there inclined to be more pseudo-skin pixels and after that this requires more erosion operations. The faces fall apart for weak light pictures due to lots of erosion. So depending on the light conditions we perform the erosion operation . The light condition can be checked depend on the median radiance value of all the pixels in the given picture. Two additional column erosions are included for strong light picture. Holes are filled so that after erosions only happen at edges of the components and do not cause regions inside faces to fall apart and it is done between the first level and second level erosion. In Figure 3(2)and Figure 3(5) a pre-processing of the binary picture that breaks connection between faces in strong light conditions is shown. The binary picture from skin segmentation that has two faces connected is shown in Figure 3(2). Figure 3(3) is the picture obtained by the first level column and row erosion.The picture obtained by the hole filling and second level column erosion is shown in Figure 3(4) .And lastly in Figure 3-5 is the picture obtained by the third level erosion with two different connected components for two faces.

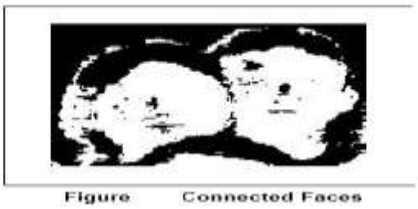


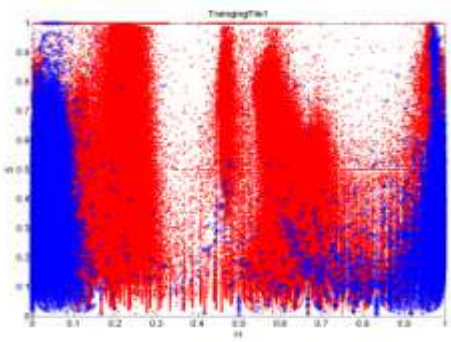
Figure Connected Faces

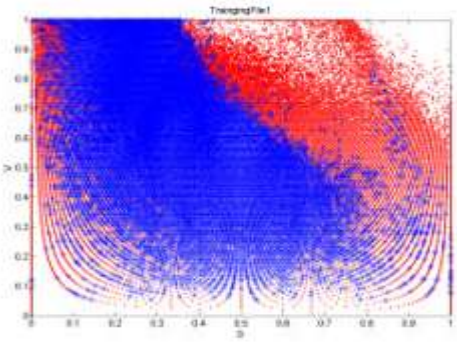
Figure First Level Erosion

Figure Hole Filling and Second Level Erosion

Figure Third Level Erosion

1.4 Color Segmentation The first step of the picture is color segmentation. Hue-Saturation-Value (HSV) color map is the most sufficient for differentiating the skin regions from the remaining photo contents and there are different color spaces are available but HSV is used . Minimizing the number of background pixels can be found engaging the area of skin regions vs. non-skin regions in Hue versus Saturation, Saturation versus Value and Hue versus Value A set of equations that maximize the amount of skin pixels while. These equations are used to generate the first binary picture.





To solve human face detection problem there have been many attempts attempted. The newly approaches have objective for gray level pictures only, and picture pyramid schemes are necessary .

II. LITERATURE SURVEY

Ma et al. [6] gave a general framework by finding the compressible features of an picture and vacating room before encryption for the secret message. Lossless compression was employed. The most common used methods for contrast enhancement fall into two categories: (1) indirect methods of contrast enhancement and (2) direct methods of contrast enhancement. Indirect approaches mainly changes histogram by assigning new values to the original intensity levels. Histogram specification and histogram equalization are two popular indirect contrast enhancement methods. However, histogram modification method only stretches the global distribution of the intensity. The main idea of contrast enhancement methods is to establish a criterion of contrast measurement and to enhance the picture by improving the contrast measure. The contrast can be measured globally and locally. It is more reasonable to define a local contrast when an picture contains textual information. Fuzzy logic has been found many applications in picture processing, pattern recognition, etc. Fuzzy set theory is a useful tool for handling the uncertainty in the pictures associated with vagueness and/or imprecision. In this paper, we shown a novel adaptive direct fuzzy contrast enhancement method based on the fuzzy entropy principle and fuzzy set theory. We have conducted experiments on many pictures. The experimental results demonstrate that the proposed algorithm is very effective in contrast enhancement as well as in preventing over-enhancement.

Tian et al. [7] introduced a pixel expansion based method to reversibly hide large amount of data. The embedding can only be repeated more than one time for additional capacity. A Fuzzy Operator for the Enhancement of Blurred and Noisy Pictures. Rule-based fuzzy operators are a novel class of operators properly designed in order to apply the principles of approximate reasoning to digital picture processing. This proposed method shows how a fuzzy operator that is able to perform detail sharpening but is insensitive to noise can be designed. The results obtainable by the proposed method in the enhancement of a real picture are presented.Fuzzy rules allow processing directives to be explained in terms of human-like reasoning.Then increase its luminance,ELSE, leave it unchanged.Such a rule, which is expressed in a plain linguistic form, can be translated into the more formal structure of a fuzzy operator.In the method proposed in the present paper, the enhancement of an picture is obtained by the superposition of two complementary effects: detail sharpening and noise suppression. The discrimination between detail and noise in the input picture is based on the amplitude of the luminance change and on the correlation between adjacent pixels.

Tsai et al. [8] introduced modified histogram shifting. The pixel intensity histogram and prediction based error histogram were used. This method identifies a vacant intensity level and shifts pixels to create a vacant room next to the peak level. The pixels are then shifted between the peak and the next zero levels in a way to the message bits.

. P. Das, et al [5] suggested hiding multiple secret pictures in a single 24-bit cover picture employing LSB substitution based picture steganography. They have encrypted a secret picture before hiding in the cover picture employing Arnold Transform.

S. Shankar, et al [6] proposed data hiding and picture encryption scheme employing random diffusion and two dimensional Arnold cat mapping transform. They also placed secret message bits in the least significant bit positions of the cover picture. The shared key is used to generate 8 bit random integer stream and also added to the stego picture in the random diffusion step.

M. Mahdavi, et.al [7] suggested a new accurate steganalysis method for the LSB replacement Steganography. The proposed method is based on the changes that appear in the histogram of an picture after the incorporating of data. Every pair of adjacent bins of a histogram are either inter-related or unrelated depending on whether embedding of a bit of data in the picture could affect both bins or not.

Chang, C.C et al [8] proposed an picture Steganography method which offers high embedding capacity and brings less distortion to the stego picture. The process of embedding embeds bits of secret bit stream on the stego picture pixels. Instead of replacing the LSB of every pixel, this method replaces the pixel intensity with a similar value. The range of modifiable pixel value is higher in edge areas than smooth areas to maintain good perceptual excellence. This method has a shortcoming

which is a boundary problem; this means the pixel which is located for embedding will become unused; since it exceeds the maximum intensity level that is greater than 255 (maximum gray scale intensity).

Guodong Ye proposed in [12] an picture scrambling method based on chaos map, which drastically changed the statistical characteristics of the pixels.

Liu et al. in [13] designed picture encryption scheme employing Arnold transform and color blend operation in discrete cosine transform domains.

Wu. H.C et al [9] proposed an improvement in the capacity of the hidden secret data so as to provide an imperceptible Stego-picture quality. This method is based on the least significant bit (LSB) replacement and the pixel-value differencing (PVD) method is also suggested in this paper. The limitation of this method is Low-hiding capacity which is attributed to mainly hiding in smooth areas. For example if a pixel value difference is 3 of the corresponding range width is 8, only 3 bits can be embedded in a pair of pixels.

Y. K. Jain et al [10] proposed an adaptive least significant bit spatial domain embedding method. This method divides the picture pixels ranges (0-255) and generates a stego-key. This private stego-key has 5 different gray level ranges of picture and each range refers to substitute fixed number of bits to embed in least significant bits of picture. The strength of this method is its integrity of secret hidden information in stego- picture and high hidden capacity. This method could be weak for hiding extra bits of signature with a hidden message for its integrity purpose. This study also proposed a method for color picture just to modify the blue channel with this scheme for information hiding. The purpose of this method is to achieve high hidden capacity plus security of a hidden message.

According to Yang et al., in [11], an adaptive LSB substitution based data hiding method for picture is proposed for achieving a better visual quality of stego-picture. The noise sensitive area for embedding is taken care of by this method.. The proposed method differentiates and takes advantage of normal texture and edges area for embedding. Employing this method one can analyze the edges, brightness and texture masking of the cover picture to calculate the number of k-bit LSB for secret data embedding. The value of k becomes high at non-sensitive picture region and over sensitive picture area (k) value remains small in order to balance the picture overall visual quality. The value (k) for embedding is calculated by the high-order bits of the picture. It also uses the pixel adjustment method for better stego-picture visual quality through LSB substitution method. The overall result reveals a good high hidden capacity, but dataset for experimental results are limited. There is no single picture which has many edges with noise region like „Baboon.tif".

C.-H. Yang et al [12] proposed that a Pixel Value Difference (PVD) and simple least significant bits scheme are used to achieve adaptive least significant bits data embedding. In PVD, the size of the hidden data bits can be estimated by the difference between the two consecutive pixels in cover picture employing simple relationship between two pixels. This method generally provides a good performance by calculating the difference of two consecutive pixels which determine the depth of the embedded bits. The proposed method hides large and adaptive k-LSB substitution at edge area of picture and PVD for smooth region of picture. In this way, therefore, the method provides both larger capacity and high visual quality according to experimental results. However, the algorithm proposed by them seems complex because of adaptive (k) generation for substitution of LSB**.**

K.-H. Jung et al [13] proposed a method of Multi-Pixel Differencing (MPD) which uses more than two pixels to estimate smoothness of each pixel for data embedding and it computes the sum of difference value of four pixels block. For a small gap value, it uses the LSB, whereas for a high difference value it uses the MPD method for data embedding. In this method the experimental data set is also too limited.

pixels for data embedding near the target pixel. Also, it uses the simple k-bit LSB method for **In [14]** the authors suggested another pixel value differencing method, which used three secret data embedding where the number of k-bit is estimated by near three pixels with a high difference value. To keep better visual quality and high capacity, it simply uses the optimal pixel adjustment method on target pixels. In this method, the histogram of stego-picture and cover-picture are almost the same, but the dataset for experiments is too small.

W. J. Chen et al [15] introduced a high capacity of hidden data utilizing the LSB and hybrid edge detection scheme. For edge calculation, two types of canny and fuzzy edges detection method were applied and simple LSB substitution was used to embed the hidden data. This scheme is successful to embed data with a higher peak signal to noise ratio (PSNR) with normal LSB based embedding. This method is tested on limited pictures dataset. Based on LSB substitution and selection of random pixel of required picture area,

Madhu et al., in [16] proposed an picture steganography method. The purpose of this method is to improve the security where password is added by LSB of pixels. It also generates the random numbers and selects the region of interest where a secret message has to be hidden. The limitation of this method is that it does not consider any type of perceptual transparency.

H.D. Cheng , Huijuan Xu[2] proposed novelfuzzy logic approach to contrast enhancement Contrast enhancement is one of the most important issues of picture processing, pattern recognition and computer vision. The most common used methods for contrast enhancement include two categories: (1) indirect methods of contrast enhancement and (2) direct methods of contrast enhancement. Indirect approaches specifically modify histogram by assigning new values to the original intensity levels. Histogram specification and histogram equalization are two popular indirect contrast enhancement methods. However, histogram modification method only stretches the global distribution of the intensity. The contrast can be measured globally and locally. It is more reasonable to define a local contrast when an picture contains textual information. Fuzzy logic has been found many applications in picture processing, pattern recognition, etc. Fuzzy set theory is a useful tool for handling the uncertainty in the pictures associated with vagueness and/or imprecision. In this paper, we givened a novel adaptive direct fuzzy contrast enhancement method based on the fuzzy entropy principle and fuzzy set theory. We have conducted experiments on many pictures. The experimental results demonstrate that the proposed algorithm is very effective in contrast enhancement as well as in preventing over-enhancement.

Prof. Mrs. Preethi S.J, Prof. Mrs. K. Rajeswari [6] Department of Computer Engineering, Pune-44, India proposed Membership Function modification for Picture Enhancement employing fuzzy logic. Objective of this method is to introduce a function called rampmembership function and the modification of membershipfunction employing square and cube operator for enhancing thevisual appearance of digital picture employing fuzzy logic basedapproach. The proposed algorithm can be applied to enhancethe medical pictures to make the implementation easy or can beapplied to colour photographs to enhance the visualappearance of the low contrast photographs taken in dark.The algorithm can also be applied as preprocessing methodfor any picture processing application like finger print detection.Algorithm for modifying Bright Membership degree function employing cube operation gives much better result as compared to existing membership function. After contrast enhancement we can adjust the intensity of an picture by increasing its brightness or decreasing its brightness to get the better quality enhanced picture. Fuzzy logic algorithm to enhance the medical pictures, color photographs and finger prints. Better results are obtained from the proposed method. So in future work there is scope of applying the algorithm to enhance video pictures

III. PROPOSED METHODOLOGY

LSB MATCHING EMBEDDING

LSB Replacement is the method of simply replacing the least significant bits of the picture pixels with the message bits. For example if the pixel value is 160 and the message bit is 0 then the modified pixel value will still be 160. If the message bit is 1 then the LSB of 150 is replaced with 1 to make the new value of 151. In LSB matching however, the two options of changes values 149 and 151 are both considered both options have LSB equal to the message bit. The choice is random made with a pseudo generator. This modification alleviates the odd/even asymmetry which compromised the security of LSB replacement [17].

EMBEDDING PROCEDURE

Arnold Mapping has low period and hence not suitable for picture encryption by itself [18]. To enhance the security, the additional step of diffusion is included. The pixel values are distorted through the addition of a pseudo integer sequence in the range of [0, 255] modulo 256. The pseudo random sequence is generated employing the shared secret key K as the random seed. Thus Alice and Bob will be able to generate the exact same sequence which will be correct. Bob will be able to reverse the encryption process however Eve without the knowledge of K will not be in a position to decrypt the picture and obtain the hidden message. The embedding procedure is as follows Step 1: The secret message is embedded in the LSB of the cover picture employing LSB matching. Step 2: A pseudo random generator is setup with the shared key K as the seed. Step 3: Arnold transform is used to sequence the pixels once. Step 4: A random unsigned 8 bit integer sequence is added to the pixels set 256. Steps 3 and 4 are repeated n times. Step 5: The resulting picture is output as the encrypted picture. The diagram for the embedding procedure is shown in Fig

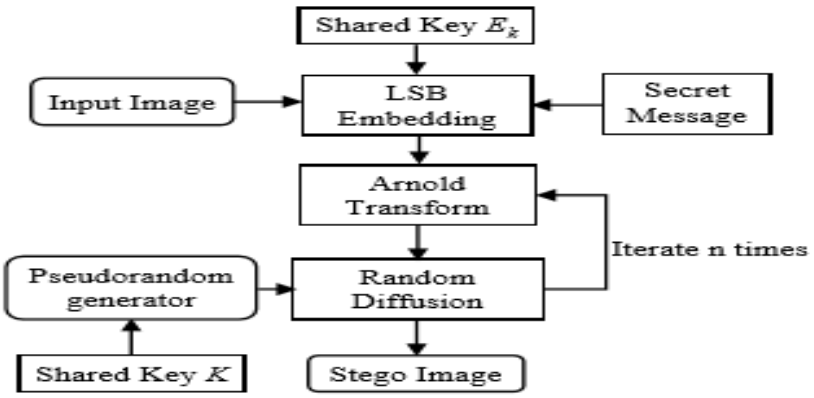


Fig.2. Block Diagram of the Embedding Procedure

The LSB embedding step is done with shared key Ek so that it can be extracted only with its knowledge by the receivers. This is extra security layer for the embedded message. The picture can be decrypted without the knowledge of Ek.

EXTRACTION PROCEDURE

The extraction procedure is as follows
Step 1: The pseudo random generator is set up with shared key K as the main.
Step 2: The entire sequences of unsigned 8 bit integers are generated to be used in the reverse the sequence.
Step 3: The random sequence is subtracted from the pixels set 256.
Step 4: The inverse Arnold transform is applied. Steps 3 and 4 are repeated n times.

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Step 5: The secret message bits are extracted from the LSB of the decrypted picture. The diagram for the extraction procedure is shown in Fig.3. This amounts to an addition of ±1 to the grayscale values. The maximum mean squared error is 1 and the peak signal to noise ratio is higher than 10log10(2552) = 48.13dB. Thus the proposed method achieves the dual objectives of picture encryption and data hiding. The embed capacity is equal to 1 bit per pixel (bpp). This is sufficient in applications like medical picture transmission where sensitive metadata or annotations has to be communicated along with private medical pictures [19]. It is also suitable for tamper proofing pictures by sending hashes computed at the sender side along with the picture [20].

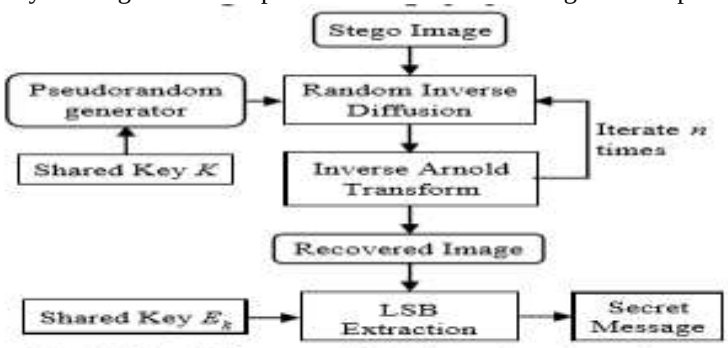

Fig.3. Block Diagram of the Extraction Procedure

IV. RESULT AND ANALYSIS

S.No	Picture name and size(kb)	PSNR value of original picture	PSNR value of Histogram Equalization Method	PSNR value of Adaptive Histogram Equalization	PSNR value of proposed algorithm
1	Pout.tif(12)	25.30	30.28	30.32	33.39
2	Cake.jpg(12.5)	30.60	27.32	25.34	32.29
3	Eight.tif(14)	25.41	25.42	30.42	30.07
4	Cameraman.tif(15.8)	25.56	27.42	30.24	33.20
5	Tire.tif(18)	26.12	29.71	30.62	33.56

Table1.1:- Comparison of Enhancement method

V. Conclusion

This work deals with the methods for steganography in discrete wavelet transform as associated to gray scale pictures and binary pictures. A new and secure steganography method for embedding secret picture into cover picture without producing any major change has been proposed. In future secret picture could be extracted only with stego picture without the availability of cover picture.

The main focus of this research is on picture enhancement employing fuzzy picture enhancement methods. Many pictures like medical pictures, satellite pictures, microscopy pictures, aerial pictures and even real life photographs suffer from poor contrast and noise. It is necessary to enhance the contrast and remove the noise to increase picture visual quality.

In the thesis work one membership function is defined to enhance the picture and algorithm is proposed. The proposed algorithm is implemented in MATLAB 7.11. One can also use any automatic approaches for picture enhancement to increase the picture quality. One of the disadvantages of the measure theory is the computational complexity if the number of elements is large.

To achieve a higher level of picture quality considering the subjective perception

Experiment was tested on poor quality pictures initially and the proposed result is compared with some existed methods. The results are analyzed and compared based on the basis of PSNR (Peak Signal to Noise Ratio) value. The PSNR is most commonly used to measure the quality of an picture; by comparing the enhanced picture with the original picture. The PSNR value has been calculated regarding each method and graph has been plotted regarding different size of picture with respect to PSNR value and it has been found that fuzzy picture enhancement method provides high PSNR value than other methods. A higher PSNR value indicates the higher quality of picture.

This proposed method is able to overcome the drawbacks of other method such as Histogram Equalization, Adaptive Histogram Equalization. This method is able to get good contrasted picture which increase the

contrasted of low contrasted pictures. The experiment result shows that brightness is increased as compared to previous one. The proposed algorithm gives good result than the other existing methods and the comparison graph has been plotted which makes this method better than the other methods. Fuzzy logic algorithm to enhance the medical pictures, color photographs and finger prints.

VI. Future Scope

Future work can be extended for other pictures than grayscale pictures to obtain better result with accuracy. Picture enhancement is a field that is being used in various areas and disciplines. Picture enhancement plays a vital role in every field where pictures have to be understood and analyzed. In future modification of the algorithm can produce the better result for the pictures. Also in future Neuro-fuzzy method can be used to enhance the picture. The better result for picture enhancement has also used in real time enhancement of neuro evolution of augmenting.

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