Encryption and Secure Transmission of Telemedicinal Image in Watermarking using DWT HAAR Wavelet Algorithm

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Abstract: This is a result paper .In this paper, watermarking using DWT Haar wavelet algorithm is used.In this papera patient brain image which is to be transmitted using telemedicine is encrypted and the records of patient brain condition is hidden along with patients document and is transmitted along the channel which can not be decrypted by any unauthorized section. The main aim of this paper is to hide the patient information along with the image and to encrypt and transmit the data along with images and to protect it from different kind of attacks and noise that mainly take place in channels. The purpose of using watermarking is that watermarking does not influence the diagnosis to be made by reducing the visual clarity of medical images. Watermarking is implemented here using DWT haar wavelet and the process include complete copyright protection. Experimental result show high imperceptibility where there is no noticeable change in the watermarked image and original image and the patients records is also hidden along with the image which is to be transmitted along the channel that cannot be hacked or attacked by any unauthorized section. The robustness of watermarking scheme is analysed by means of performance evaluation of peak signal to noise ratio (PSNR)

Key word; *- DWT Haar wavelet, MSE, PSNR, digital watermarking.*

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I. INTRODUCTION:-

a).What is Telemedicine?

By the use of electronic medium,for the purpose of improving the health of a patient clinically ,we are using the exchange of medical information fron one area to another area,which in general term is called as telemedicine.There are varieties of applications growing these days including many services using two ways video,emails,wireless tools and many other electronic and telecommunication technology. E-health including patient portals,nursing call centres, still image transmission,video conferencing regarding patients consultations,medical education in a continuous manner are all coming under telemedicine and tele health part.It is found a rapid spread in the use of telemedicine and it is now becoming integrated into the ongoing operations of hospitals,consumer's homes,workplaces as well as private physician offices.Telemedicine is also giving a considerable participation in the investment section of the country by its services and products by health care institutions either in the delivery of clinical care or in information technology.

Services Can Be Provided By Telemedicine:

Sometimes telemedicine is best understood in terms of the services provided and the mechanisms used to provide those services. Here are some examples:

a.For the purpose of providing medical education:

Telemedicine is used for thepurpose of providing education credits in medical field in continuous manner for health professionals.It is also providing special seminars related to medical education for some of the special group that are targeted in remote location.

b.To monitor the patient located in remote areas:

This is a very important application of telemedicine. To supplement the use of visiting nurse this services can be used.The heart ECG or different type of indicators for home bound patient or blood glucose are coming under this application which is including a specific vital sign.

VARIOUS BENEFITS OF TELEMEDICINE:

Telemedicine has been growing rapidly because it offers four fundamental benefits:

To fulfill Patient's Demand –Because of telemedicine technologies the travel time and other related stress for the patient has reduced. Telemedicine is providing satisfaction to the patients and it is proved by the past 15 years documentary studies. And therefore consumers are desiring for telemedical services. Patients are now able to access to providers that might not be available otherwise, and also without going to a long distance travel it is also provided with medical services.

Efficient cost – It is one of the most important reason for adoption of telehealth technologies that it is reducing the cost of healthcare.The reduced cost has been shown by telemedicine for healthcare and efficiency is increased via highly better management of various chronic diseases,fewer hospital stays,and reduced travel time.

For improvement of Quality –Telemedicine is delivering a superior product that is giving a very good outcomes and highly satisfied patients in mental health and ICU care particularly.

Improved Access – A good improvement in telemedicine is found in both urban as well as rural areas because shortages are given to providers by telemedicine.Telemedicines has brought closeness to the patients located in remote areas with health care services so telemedicine is playing a very good job.

INTRODUCTION TO THE HAAR WAVELET:

ANALYSIS OF WAVELET:

Because it is giving a wave like oscillation so it is called as wavelet,and the beginning of amplitude ow wavelet takes place at zero.This amplitude initially increases and then decreases and then come back to zero. Typically,it can be visualized as a "brief oscillation "for example the oscillation that is recorded by seismographic report or the oscillation recorded by heart monitor one might can see this.Actually wavelets are having very specific properties and it is purposefully crafted with this properties to make it useful for signal processing. From many different kinds of data, including audio signals and images wavelets can be used to extract information as a mathematical tool. As a branch of mathematics, Wavelet transform developed rapidly, which can analyze the details of any scale and frequency and which has a good localization property in the frequency domain and time domain. It has been widely applied and developed in image processing and compression and it is superior to DCT and fourier transform.

The improved version of Fourier transform for any function is the wavelet transform.For any stationary signal to analyse the component it is having the fourier transform is a powerful tool. wavelet transform allows the components of a non-stationary signal to be analyzed whereas fourier transform is failed to analyze the component of nonstationary function.

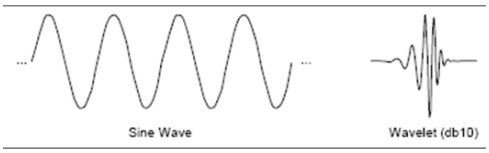

Fig: sinusoidal wave

Wavelet is a waveform actually which is having effective limited duration with an average value of zero. The difference between a sinusoidal wave and a wavelet is that sinusoids is having its extension from minus infinity to plus infinity and also sinusoids is not having any limited duration. sinusoids are having smooth and predictable but wavelet is irregular and symmetric.

The difference between a fourier analysis and a wavelet analysis is that there are many breaked up signals into different frequencies of sine waves but in case of wavelet analysis includes breaking up of signal into shifted version and scaled version of original wavelet.

Dwt wavelet:
Discrete wavelet mainly involves image decomposition intl o frequency channel of constant bandwidth.There are mainly four component named as LL,LH,HL,HH in which the input image is decomposed by DWT.Among the four components the first letter resembles to applying the either in a low pass frequency operation or high pass frequency operation to the row.Agiving ain the second letter corresponds to the operation of filters applied to the coloumn part.LL is the lowest resolution level which is including approximation part of the original image.The detailed part is contained in the rest of the three resolution level.(LH) it is vertical high resolution.(HL)is giving horizontal high resolution.(HH) is giving high frequencies.The concept of DWT watermarking scheme and DCT watermarking scheme is almost the same however thereis only variation in the transformation process of a picture into its transform domain and therefore it is resulting different coefficient. The above decomposition is called as mallet algorithm.

Haar wavelet technique:

of the wavelet transform the discrete variant is the DWT. The valid alternative used in standard JPEG to the cosine transform is represented by the Wavelet transform.The DWT algorithm of an image is based on transformation in tree structure form by representing in n level form and the implementataion is done by using filters of appropriate filter.The main thing which is very essential is following the two strategies that are very different from each other.The basic difference is depending on the criteria that is used to extract strings of image samples which is then elaborated by the banks of filter. Most image watermarking schemes operate either in the DCT (Discrete cosine transform) or DWT (Discrete wavelet transform). The main significance of mallet tree decomposition is in that it is used in the connection of discrete time filter to continuous time multi resolution.

WAVELET COEFFICIENT AND SELF SIMILARITY:

For an intuitive point of view there is a calculation of resemblance index between the signal and the wavelet.For stronger resemblance the index should be large otherwise it is slight.This indices give wavelet coefficient .If there is similarity in the signal at different scale then the resemblance index or wavelet coefficient also will be similar at different scale.This self similarity generates a characteristics pattern.

II. LITERATURE REVIEW:

A robust quantization-based image watermarking scheme, called the gradient direction watermarking (GDWM), based on the uniform quantization of the direction of gradient vectors embeds the watermark bits in the direction (angle) of significant gradient vectors, at multiple wavelet scales. Increasing the difference in the magnitude of the watermarked and the unwatermarked vectors was also proposed to help identify the watermarked vectors correctly. The simulation results [1]demonstrate that the proposed method yields superior robustness to different types of attacks, in comparison with other state-of-the-art watermarking methods.

Optimization of Size of Pixel Blocks for Orthogonal Transform in Optical Watermarking technique is novel technology with which the images of real objects with no copyright protection could contain invisible digital watermarking, using spatially modulated illumination. In

this "optical watermarking" technology, used orthogonal transforms, such as a discrete cosine transform (DCT) or a Walsh-Hadamard transform (WHT). The experimental results [2] proved that it was practical and that the accuracy of detection of data embedded with optical watermarking could be improved with more pixels in each block. produced watermarked images and a complicated structured image was used as an object image. also clarified that robustness against various disturbances became a trade-off in optimizing embedded watermarking data, as the volume of information using blocks with 16 16 pixels that could be embedded into data for the watermarked image was lower than that using blocks with 4 4 or 8 pixels.

an improved non-blind watermarking algorithm based on discrete wavelet transform was forwarded in An Improved Watermarking Algorithm to Colour Image Based on Wavelet Domain [3]. Watermarking applies special meaningful color image. It is improved application algorithm based on the wavelet domain with digital image watermark technology .It presented a method that combines image watermarking and encryption technique for safe image transmission purpose. Image Watermarking using Least Significant Bit (LSB) method has been used for embedding the information. This presented a method that combines approach of cryptography, watermarking is used. In this method the image is embedded using watermarking method with patient information and then embedded image is encrypted

A new method to prevent skipping attack without impacting the overall performance of computation. cryptographic implementations should resist against fault attacks . Among them, we quote a special type of attacks against RSA , which we refer to as skipping attacks. We present an efficient method to thwart the attacks and detail some implementations[5].

A novel method for region based image watermarking that can tolerate local distortion using inverse DWT is presented in this paper[6]. The first stage of the method relies on computing a normalized version of the original image using image moments. The next step is to extract a set of feature points that will act as centers of the watermark embedding areas. Four different existing feature extraction techniques are tested: Radial Symmetry Transform (RST), scale-invariant feature transform (SIFT), speeded up robust features (SURF) and features from accelerated segment test (FAST). It has given a remarkable performance in geometrical attacks and signal processing attack.

An algorithm using Arnold scrambling to preprocess on original watermarking and improve the security of watermarking is presented by this technique[7]. Without knowing the scrambling algorithm and key, the attackers can not recover the images even after extracting the watermarking from the watermarked image. Such additional encryption provides double protection for medical images and showed that the algorithm has robustness for geometrical attack and common attacks.

To prevent a patients document from attack in telemedicine is presented by watermarking algorithm operating in discrete cosine transform[8]. The algorithms are very much applicable for applications such as copyright protection, copy control and owner identification. In this Paper the watermarking is accomplished by embedding the watermark into mid frequency range according to the characteristics of the human visual system (HVS).PSNR for host image, Watermarked images along with Embedded watermark, Retrieved watermark are compared. The PSNR values are compared for different kinds of malicious attacks**.**

A new watermarking algorithm for Telemedicine applications using DCT and DWT haar wavelet is developed for different level of decomposition. In this work the watermarking of medical image is done in DCT and DWT domains and the performance is evaluated based on PSNR and MSE and concluded that DCT using haar wavelet performs quite better than DCT[9]. Secondly the watermark embedding in different decomposition levels is analyzed and found out that the third level decomposition gives better results.

A new approach for watermarking of medical images to check integrity of patients data in network sharing.

In this paper[10], approach is intended to insert a set of data in a medical image. These data should be imperceptible and robust to various attacks. It's containing the signature of the original image, the data specific to the patient and his diagnostic. This method is perfectly suited to medical imaging from the use of least significant bit (LSB) of the image, allowing the patient to insert its own information while keeping a quality of watermarked image.

III. METHODOLOGY

The DWT haar wavelet algorithm .

As comparison to the normal set of images, nuclear images are containing very less information in mid frequency range.There the main thing that is to do is that the patients image that are required to keep confedientiial are taken as watermark image and is embedded in mid frequency range.this embedding of patients details in mid frequency of host image is done for better PSNR .

Encryption process:

The image on which watermarking is to perform is taken as host image .The host image is taken as nuclear image of 256*256.To hide the data the patients record is used as watermarked image.

DWT haar wavelet is applied to host image i.e is the nuclear image and coefficient matrix „A" is obtained. "B" is taken as Coefficient matrix of the watermark image is obtained by applying DWT haar wavelet on watermark image separately. Singular values are calculated for each obtained matrixes "A "and "B"separately. Singular values of matrix "A" are modified by adding singular values of matrix "B" in mid-frequency and hence the host image is hided by watermarked Image.

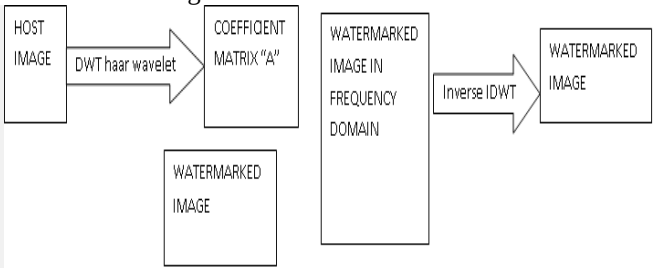

FIG 3.1 block diagram of embedding of watermark image using DWT haar wavelet

Steps for performing encryption:

1 .A nuclear image called as host image or original image is taken of the size 256*256.This is called as coefficient matrix A

2. A patient image to be hidden is considered as watermarked image is taken of the size 64*64.This is called coefficient matrix B.

3. Mid frequency value of coefficient matrix "A" is replaced with intensity value of "B" to obtain watermarked image in frequency domain.

4. Watermarked image is obtained by applying inverse DWT haar wavelet to the coefficient matrix "A".

IV. EXPERIMENTAL RESULT:

For evaluation of the developed algorithm experiments are conducted using gray scale nuclear images.

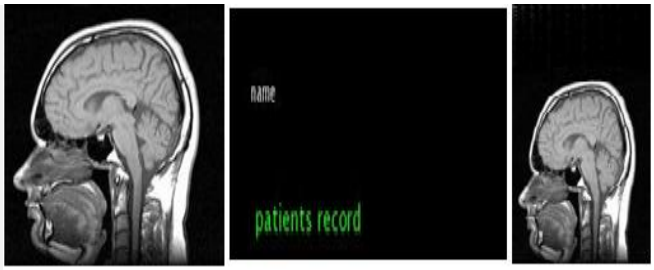

Fig (a).image of patient brain Fig (b).patient record.(host image) Fig.(c) embedded image

(watermarked image)

In the above given figures,figure a is representing the image of a patient brain which is actually the watermarked image. Figure b is representing the host image which include the patient data that is patients record which is needed to hide so as to prevent it from hacking.figure c is representing the embedded image on which the patient data is hided inside the watermarked image using DWT haar wavelet. There the result is showing good quality of picture as comparison with DCT and secured information.

V. CONCLUSION:

Telmedicine is an upcoming field in the area of health science and this health science area is arising from the proper fusion of medical science and (DCT) that is information and communication technology.This is having enormous potential in meeting the challenges of medical issues and health care problem of rural areas.

To solve the above problem so as to meet a secured transmission of medical data a variety of imperceptible watermarking schemes ,ideas ,methodology and algorithms have been proposed over the last few years.most of the method proposed are said to be having suitability for either copyright protection of the data or suitable for the authentication purpose but this suitability is only for the single specific purpose. But there is no investigation is done on applying the same concept ,algorithm and scheme on other application as well.

So the proposed algorithm that is DWT haar wavelet is providing the solution by following ways:

1. Transmission and storage overhead are reduced by using the the proposed watermarking algorithm .

2. Since the proposed algorithm is eliminating the problem of transmission and storage overhead therefore no additional file is sent.

3.The diagnosis made by doctor and the prescribed data given by doctor is done so as to provide security and ca n be sent to another doctor if required.

4.The data given by the doctor is uneditable so legal prosecution against the unintentional and intentional diagnosis made by the doctor can done easily if required.

5. The watermarking scheme does not influence the diagnosis made by reducing the visual clarity of the image because the patient information is hidden and it is invisible and the imperceptibility of the image it does not change actually.

6. In any way the diagnosis value of the does not get lessened.

7. The proposed algorithm give a very effective utilization of memory and efficient transmission time and cost.

8. In various application such as copyright protection, owner identification and copy control the algorithm are very much applicable.

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