An Innovative Mkahe And A Novel Qfwc Of Crop Images In Agriculture Field

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Abstract: In the field of agriculture, the images of crops are captured for checking the quality and growth of the crops. The images are transmitted to the different places based on the concept of Internet of Things (IoT). At the time of transferring the images, the images are in the state of high (i.e.) can be corrupted or hacked by the unauthorized persons. Hence this research paper is proposed for providing security to the crop images encryption, decryption, compression and decompression are performed. In this paper, an innovative Multikey Adaptive Homomorphic Encryption (MKAHE) algorithm is utilized for performing the encryption process. And in addition to this another novel algorithm of Quantized Fraction Wavelet Compression (QFWC) is employed for carrying out the compression process. The performance analysis is carried out by calculating the values of various performance metrics like PSNR, compression ratio and encoding time for the proposed work. Then these performance measures are compared with the performances of the existing and classic method. Then the compressed image is decompressed followed by the process of decryption. The values of PSNR, compression ratio are increased and similarly the value of the encoding time gets reduced.

Index Terms: Agriculture, Internet of Things (IoT), Encryption, Decryption, Compression, Decompression, Multikey Adaptive Homomorphic Encryption (MKAHE), Quantized Fraction Wavelet Compression (QFWC).

1 INTRODUCTION

Thecurrent food sector can be converted into completely into a new area, where the inputs required for performing agriculture can be reduced along with the wastages of foods by the utilization of IoT in the agricultural sector[1]. Implementing the LSPs (Large Scale Pilots) based on the IoT concept in the whole supply chain itself is considered as a major positive.

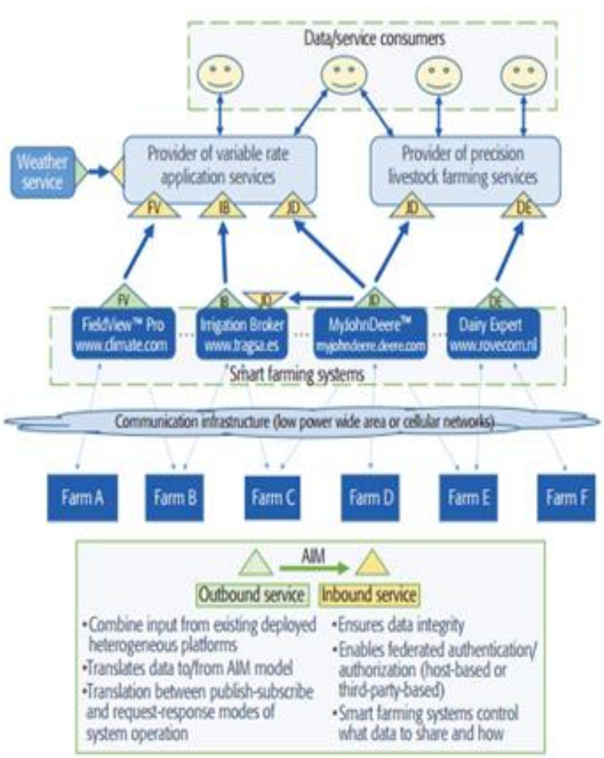

***Fig. 1**. A LSP (Large Scale Pilot)in the agriculture sector based on IoT*

An instance of outbound and inbound type of service which enables the exposure and consumption of data by AKIs is illustrated in the above Fig. 1.It helps to the survey services by means of rapid deployment and does not involve the feed from a specific AKIS in a continuous manner. Therefore an inbound services are deployed and initiated for the specific Agriculture Knowledge Information Systems (AKIS), then the required informations are gathered and finally the services cease to function. Self-contained services like encryption techniques,libraries for supported communication protocols, runtime environment, etc. are deployed and are well supported by a lightweight container with the all the required software. The evolution of knowledge management systems has enabled the farmers to know about the information related to the agricultural field and an enhanced knowledge to make quick and accurate decisions. [2]Through the aid of multimedia, queries raised by the farmers can be easily answered. In developing countries the usage of ICT (Information and Communication Technology) provides with vast opportunities for promoting the agriculture sector among various areas and aspects. Issues prevailing in the utilization of energy, power and cost consuming equipments technology can be overcome through employing suitable wireless technology, networking and mobile, etc. To overcome the utilization of energy, power and cost consuming equipments technology has crossed by using wireless technology, networking and mobile, etc. and it is very helpful to improve the progression of agriculture. Progression of ICT has resulted in creatinganinterest in increasing the investments by the private sectors towards the usage of ICT in agricultureand related research. Process of segregating an input image to various parts is known as image segmentation. Currently there are numerous techniques present for segmenting the images that varies from basic threshold techniques to innovative techniques of colour images segmentation [3]. These images normally matches so that they can be kept in a secluded place and helps the humans to treat these images as individual ones. Since computers are not capable of recognizing these object with its available intelligence, segmentation of images is carried out through the usage of numerous segmentation approaches. Segmentation is performed by various features present in the image. The features could either be boundaries of image, segment of a picture or color data in a image. In the past few decades, hyperspectral imaging spectrometers have been thoroughly studied. [4] The electromagnetic energy is measures in hundreds of wavelengths in their immediate field of view. Due to the presence of higher spectral resolution of <10nm (nanometer), materials with slight spectrum variation can be distinguished. Products of a subtle difference in spectrum can be distinguished. In recent times, based on the help of the National Space Organization in Taiwan, a concave grating hyperspectral spectrometer of 2D (two dimensions) was created.

2 RELATED WORKS

2.1 Encryption and Decryption

[5]Performed encryption and decryption based on QR code in a gray scale image. A novel scheme was proposed with the intention of encrypting and decrypting a gray scale image optically based QR codes. This QR based technique was employed for the very first time in the encryption and decryption process. The scheme was proposed in a way that even common and basic QR code readers and generators are compatible it. Based on the results obtained at the end of the simulations, it was proved that the scheme proposed in the research paper possess the capacity to encrypt and decrypt an image accurately which was given as input. [6] Based on image correlation decomposition, an innovative algorithm was proposed for the encryption and decryption and quantum gray-level image. By making use of the measurement principle besides superposition principle of quantum state, the correlation between different pixels in an image was determined. Various series of sub images were separated from an entire quantum image. A fulfilled binary tree array which was developed with the intention of storing the sub images. Based on the superposition principle, the sub images were superimposed together for forming an encrypted image. Rotation angle, orthonormal basis states, random phase gate and binary sequence etc. acts as the key parameters for the proposed encryption algorithm. Complexities experienced during computation and security provided by the algorithm proposed in the work were investigated. Even a very brutal force attack can be resisted as the proposed encryption algorithm consist of a greater key space. When compared to the existing algorithms, the proposed algorithm have a very less complexity at the time of computation. [7] An innovative scheme of RDH(Reversible Data Hiding) was proposed in the research paper which makes use of various concepts like orthogonal decomposition, wavelet transform and histogram shifting for the encryption of digital images. The operation of data hiding in the domain of encryption was facilitated by the independent nature of Laplacian coefficients, distribution of the high frequency integer wavelet coefficients in the high frequency sub-bands similar to the distribution of Laplacian and maintaining the reversibility nature were some of the merits present in the scheme. From the results obtained at the end of the experimentations, it was confirmed that the proposed approach overcomes other previously existing works related to RDH by means of increased value of PSNR for the same rate of payload. This proposed approach could be employed to every natural images which have higher rate of embeddings when comparing with the other previous approaches. [8]A privacy preserving image processing scheme was presented which provides assistance to the studies regarding design related studies. The challenges faced at the time of constructing the proposed scheme based on cloud were determined.Various tasks in image processing such as detecting the features in an image, searching images based on the content and digital watermarking. And similarly different innovative approaches like computation of secure multiparty, homographic type of encryption were also inspected. Nomenclature of the proposed work and its respective solutions was also delivered at last. [9] An innovative approach was proposed in the paper which utilizes various techniques like QFST (Quaternion Fresnel Transforms), hologram created by using the computer and LASM (Logistic Adjusted Holistic Manner). Two different classifications of QFST were defined for treating the four images in a complete method. Along with this the respective evaluation technique was also derived separately for the quaternion matrix. A total of four original images were utilized in the proposed approach. These images were characterized by the quaternion algebra and were completely processed at the first step with the help of QFST. By utilizing Fresnel transform along with the two virtual independent RPM (Random Phase Masks), the input complex amplitude of an image was encoded. This amplitude was developed by using the elements present in plain text images which were transformed by QFST. Then with the aid of Burch's approach, the encrypted hologram generated by computer and the phase shifting interferometry were produced. The correlation and security were enhanced and also the encrypted hologram was also scrambled by using two dimensional LASM. Finally the validity of the proposed image encryption approach was verified with the help of the results obtained during the experimentations.

2.2 Compression and decompression

[10]In this study, a brief performance comparison of the discrete wavelets such as Daubechies and Haar for the implementation. The chief aim of the work is to analyze the gray scale image with wavelet theory technology. It has been worked with 2D-DWT and MATLAB toolbox. The corresponding experiments and the outcomes were performed on .jpg images. It provides a best application for the developers for choosing the best wavelet system for use. Quality of the image was calculated by conventional distortion measures like MSE and ER and the image comparison in Koala.jpg image. [11]Proposed the Lempel-Ziv-Welch (LZW) Lossless Compression approach for watermark compression. The image content must be altered because of the presents of noisy communication and hacking manipulation. In medical field, the image data was very sensitive. If the medical based analysis could change in illegally it provides the wrong medical decision. To rectify this issue the digital watermarking method was used for authenticating images and recovering illegal images. The proposed LZW lossless compression method mitigates the watermark payload and data loss. In this study, it combines the region of interest with watermarking secret key. ROI (Region of Interest)authentication mainly utilized for lossless recovery. In result analysis, the performance of proposed method was compared with other conventional methods. [12]The study explains the development of plant disease recognition using concept of soft computing along with the image processing concept.Recognition model is developed with respect to the discolored extracted features and computing approaches. Color spaces that either depends or not depends on the device consist of three features like frequency features, statistical features and hybrid features. A separate system for the recognition of various diseases was developed based on the selected features and color spaces.The input image preprocessor is differentiated in various color spaces based on the suitability. After the

development of plant disease the queries about the color spaces effects and regarding the recognition system that identifies the features might be asked. The images were assessed through the use of RGB color space and convertedthrough the usage of L*u*v color space for segmentation byC-means andK-means. A brief explanation regarding the relationship among various feature sets, disease recognition system's performance and about color spaces were represented in the paper. The processed image color processes are R, G, B, H, S and V. The optimized feature was utilized for the designing of tomato disease classifier. A survey explained about applications and techniques like machine learning, video and image processing to solve agricultural problems. The study concludes that the influence of color spaces and feature sets represents in plant recognition model. Examination was carried out only among the plant images that were captured on the front side of the plant. It was carried out in an uncontrolled environment in daytime. After analysis of disease the disease recognition system works well. The future investigation focuses on warning system which provides warning regarding the plant disease in a much earlier stage. This examination was performed with respect to the six classifications of disease in rice plants. Vital discoveries were obtained at the end of the examinations that helps to identify the category of disease found in rice plants and various other plants. [13]Proposed to found out image processing is a technique which process digital information stored in the form of pixels. The process that is involved in the image processing is to convert an analog image into digital image and there are two image formats they are input and output. The digital image processing is divided into six they are Image acquisition, Image pre-processing, Image segmentation, Feature extraction, Classification based on classifier and Statistical analysis. Now a day's plants are affecting by many diseases they are devastating economic, social and ecological losses and many more. Image processing is the most common application of neural network it is used to remove the face spoofing by matching the original image in the database, compression of image or minimize loss, etc. the plant detection disease is the approach to detect the disease from the input image. The study concludes that the plant disease detection can be applied with technique of feature extraction, segmentation and classification. It approaches design of plant disease detection based classification. [14] The paper explains the reduction in dimensionality by keeping the original data, and it eliminates noise and junk data. This method analyses a different kind of hyperspectral imaging, which stores the data of a variety wavelength path by solar-reflected infrared spectrum. The applied methodology is NMP to noise reduction and linear reduced dimensions and ML-ELM (Multi-Layer Extreme Learning Machine)for classification of hyperspectral imaging, PCA (Principal Component Analysis) for better compression, NMF (Negative Matrix Factorization), ICA(Independent Component Analysis), and MLP (Multi-Layer Perceptron) for faster execution and error and flaw reconstruction. The proposal showed that it successfully results in compression and usage of the high dimensional image in real-time applications without any data loss or data corruption with the minimal response time. This method makes use of ANN (Artificial Neural Networks) for high performance, relied on extreme learning machine.

3 PROPOSED WORK

The proposed work consists of two newly developed algorithms separately for the encryption and compression process. The overall flow of the proposed method is described in the Fig.1. The detailed explanation of the overall flow is mentioned below.

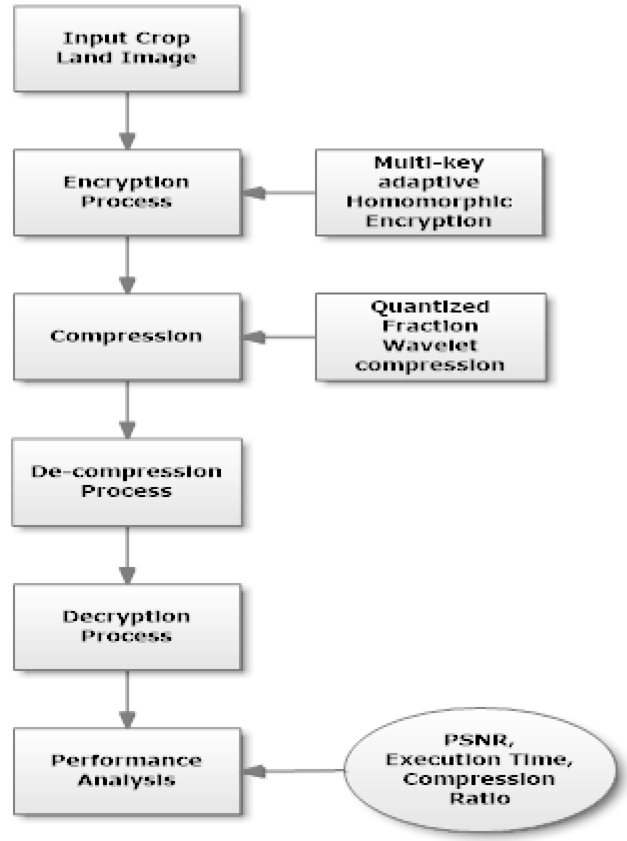

Fig. 2*. Overall Flow of the proposed method*

The crops in an agricultural land were captured in the form of images. These images are known with the name of hyperspectral images. These images of the land crops are given as input proposed method. The input images subjected to the encryption process. By utilizing the Multi-Key Adaptive Homomorphic Encryption (MKAHE) algorithm, the input crop images are encrypted and processed to the next step. In the following step, the encrypted image is compressed by utilizing the novel Quantized Fraction Wavelet Compression (QFWC) algorithm. The encrypted and compressed image cannot be interpreted by any unauthorized users. The authorized users are only allowed to contain the multiple keys generated by the MKHAE algorithm. With the generated key, decompression is carried out for the decompressing the encrypted image. Consequently, decryption process is also performed for convertig the encrypted image to a readable one. After this performance analysis is carried out in the decrypted image. The performance of the image can be evaluated by using the performance measures such as PSNR, Execution time and Compression ratio.

3.1 MULTIKEY ADAPTIVE HOMOMORPHIC ENCRYPTION (MKAHE)

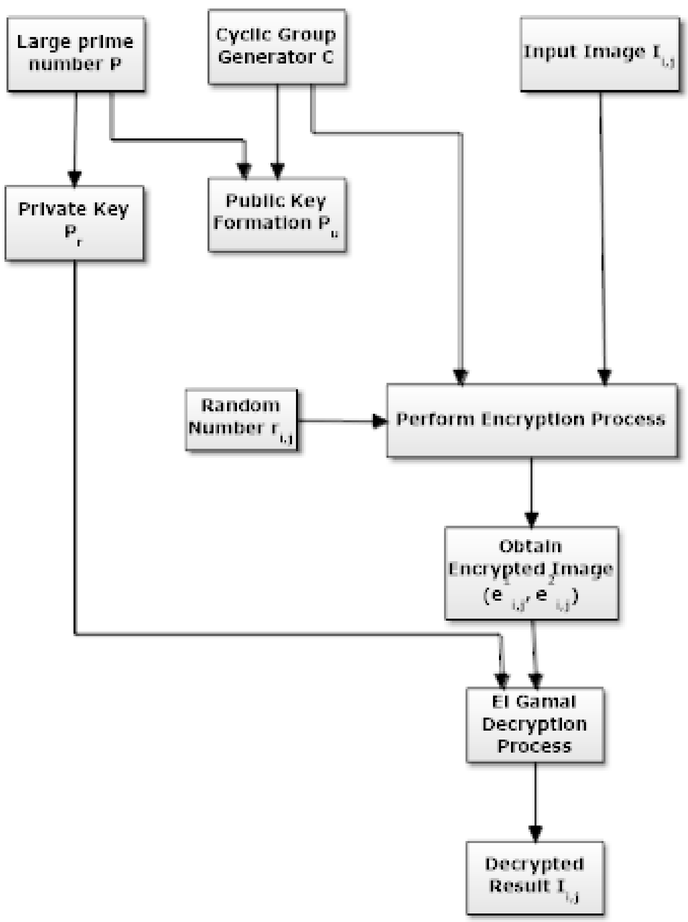

***Fig. 3**. Flow of the proposed Multi-Key Adaptive Homomorphic Encryption (MKAHE) algorithm*

Adaptive homomorphic type of encryption technique is employed in various research works for performing the encryption process. But in this proposed algorithm of Multikey Adaptive Homographic Encryption (MKAHE), multiple keys are generated and the process involved in the generation of multiple types of keys are considered as the novelty involved here. First larger prime numbers are generated. Based on the larger prime numbers, multiple keys like private key and public keys are formed. Cyclic group generator is employed in the algorithm for generating numerous samples in a random manner. This cyclic group generator is also utilized in the formation of public key as well. Along with the random numbers that are generated, the input images are processed for performing the encryption process. After the encryption process, the encrypted image is obtained. By making use of the EL Gamal technique, the decryption process is carried out. Then finally the decrypted image result is obtained.

Algorithm I : Multi Key Adaptive Homomorphic Encryption (MKAHE) algorithm

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Input: Large prime number p, Image I
Output: Encrypted text $(\mathrm{e}_{\mathrm{i,j}}^{1}, \mathrm{e}_{\mathrm{i,j}}^{2})$ and decrypted image $\mathrm{I}_{\mathrm{i,j}}$

Procedure:
Step 1: Estimation of Public key and private key with generated prime number,

$$P_u = c^{P_r} mod\ p$$

$c$is the cyclic group generator $\epsilon\{c^0, c^1, \ldots, c^{p-1}\}$
$P_r$is the set of private key$P_r \epsilon\{0,1, \ldots, p-1\}$
Set of public key is(p, g, P_u)

Step 2:apply encryption process for each pixel of the input image with respect to public key, obtained the following cipher image

$e_{i,j}^1 = c^{r_{i,j}} mod\ p$ and $e_{i,j}^2 = {P_u}^{r_{i,j}} I_{i,j}\ mod\ p$
$e_{i,j}^1$&$e_{i,j}^2$ are the cipher text,
$r_{i,j}$is the random value for each pixel,

Step 3: Applying ELGamal decryption of the encrypted image data$(e_{i,j}^1, e_{i,j}^2)$with the private key,

$$I_{i,j} = \frac{e_{i,j}^2}{\left(e_{i,j}^1\right)^{Pr}}$$

3.3QUANTIZED FRACTION WAVELET COMPRESSION (QFWC)

Normally, Discrete Wavelet Transform is employed for performing the compression process. But here, a novel Quantized Fraction Wavelet Compression (QFWC) is utilized for the compression process.

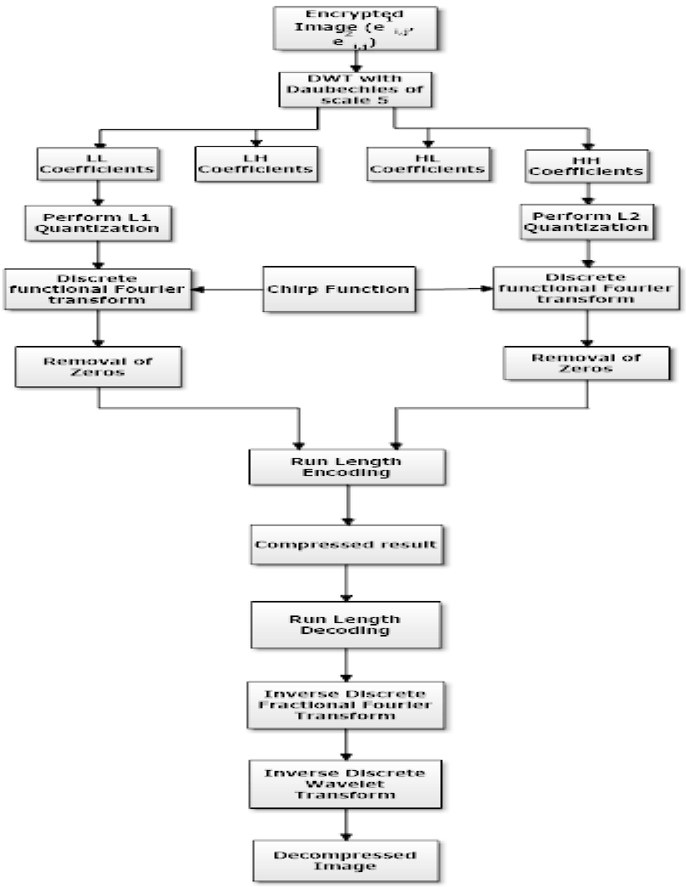

***Fig. 4**. Flow of the proposed Quantized Fractional Wavelet Compression (QFWC)*

The encrypted image is given as the input to this compression process. First the discrete wavelet transform is performed with the help of the Daubechies of scale 5. Then various co efficient like Low-Low (LL), Low-High (LH), High-Low(HL) and High-High (HH) are generated. Quantization process is performed for the coefficients. Then the discrete functional fourier transform is done by using the chirp function. The zeros present in the fourier transform are removed. After this, the run length encoding is done for obtaining the compressed result. Then the compressed result is subjected to run length decoding. Finally the Inverse Discrete Fractional Fourier Transform and Inverse Discrete Wavelet Transform is performed consecutively for obtaining the final decompressed image.

Algorithm II : Quantized Fractional Wavelet Compression

Input: Encrypted Image $(e^1_{i,j}, e^2_{i,j})$
Output: Compressed image and decompressed image

Procedure:
Step 1:Apply discrete wavelet transform with the wavelet Daubechies of scale as 5,

$$[R, C] = size(e^2)$$

$$LL = \frac{1}{\sqrt{R*C}} \left\{ \lim_{t \to 1\ to\ R*C} (L(t) * \varphi(t)) \right.$$

$$LH = \frac{1}{\sqrt{R*C}} \left\{ \lim_{t \to 1\ to\ R*C} (L(t) * \Psi(t)) \right.$$

$$HL = \frac{1}{\sqrt{R*C}} \left\{ \lim_{t \to 1\ to\ R*C} (H(t) * \varphi(t)) \right.$$

$$HH = \frac{1}{\sqrt{R*C}} \left\{ \lim_{t \to 1\ to\ R*C} (H(t) * \Psi(t)) \right.$$

Where LL is the approximate coefficient, LH is the detailed coefficient 1, HL is the detailed coefficient 2, HH is the detailed coefficient 3. The lower L and higher H coefficient is estimated by following equations,

$$L(t) = \frac{1}{\sqrt{R*C}} \lim_{t \to 1\ to\ R*C} (e^2(t) * \varphi(t))$$

$$H(t) = \frac{1}{\sqrt{R*C}} \lim_{t \to 1\ to\ R*C} (e^2(t) * \Psi(t))$$

$\varphi(t)$ is the scaling coefficient and $\psi(t)$ is the wavelet coefficient which is mentioned here,

$$\varphi(t) = \begin{cases} 1 & 0 \le t < 1 \\ 0 & else \end{cases} \text{and} \Psi(t) = \begin{cases} 1 & 0 \le t \le 1/2 \\ -1 & 1/2 \le t \le 1 \\ 0 & else \end{cases}$$

Step 2:Perform level 1 quantization of the decomposed image which is improved the correlation,
$F_{LL} = Q_s * median(LL)$ and $F_{HH} = Q_s * median(HH)$
Q_s is the quantization scale which 0.01 for LL and 0.1 for non-LL sub bands.
F_{LL} is the LL sub bands factor and F_{HH} is the HH sub bands factor.
$median(.)$ is the median function which is estimated the median value in the LL or HH sub bands.
$Quan_{LL} = round(\frac{LL}{F_{LL}})$ and $Quan_{HH} = round(HH/F_{HH})$
Step 3:Apply discrete fractional Fourier transform (DFRFT) with the optimal fractional order

$$Quan_{LL}{}^{DFRFT}(t) = e^{-j\pi t^2 \tan(\frac{\alpha}{2})} Quan_{LL}$$

$$Quan_{HH}{}^{DFRFT}(t) = e^{-j\pi t^2 \tan(\frac{\alpha}{2})} Quan_{HH}$$

The above process is performed with the chirp function, α is the fractional order
Step 4:Above process is repeated for every 4x4 block sliding from left to right and up to below of the sub bands
Step 5: removal of zeros in the block and perform Run length encoding for the quantized transformed results

$$C_{vec} = RLE\left(Quan_{LL}{}^{DFRFT}\right) \&\&\ RLE\left(Quan_{HH}{}^{DFRFT}\right)$$

Step 6:Perform run length decoding of the compressed image, inverse discrete fractional Fourier transform (DFRFT) and finally perform the inverse discrete wavelet transform where reconstruct the lower and higher coefficients.

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4 PERFORMANCE ANALYSIS

Performance of the proposed approach is evaluated in this performance analysis section. The results of the prosed method is compared alongwith existing and classic methods.

4.1 PERFORMANCE METRICS

MSE

The squared error present between the initial original image and final compressed image are evaluated by utilizing the two very important performance metrics like MSE and PSNR. Based on the below mentioned formula, the value of Mean

Squared Error is calculated.

$$MSE = \frac{\sum_{M,N}[l_1(m,n)-l_2(m,n)]2}{M*N} \quad (1)$$

PSNR

The value of Peak Signal to Noise Ratio (PSNR) present among the two images is evaluated. The compressed or reconstructed image quality will be better if the obtained PSNR value is high. With the help of this ratio, the quality of the actual and compressed image can be determined. The peak error measure can be indicated by utilizing the PSNR value. Based on the below mentioned equation, the value of PSNR is evaluated.

$$PSNR = 10log10\left(\frac{R^2}{MSE}\right) \quad (2)$$

ENCRYPTION TIME

Encryption time is referred as the time taken for encoding an image at the time of the broadcast. In order to improve the efficiency of the image transmission, the encoding or encrypting time of an image should be reduced.

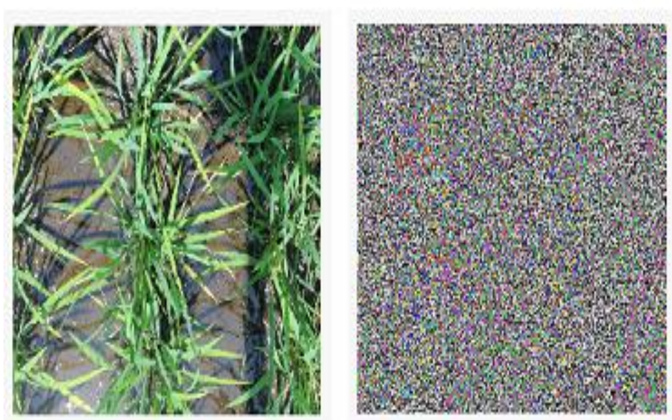

Fig. 4. *(a) Input Image* *(b) Encrypted Image*

Encryption is performed for the input image in order to secure the image. Compression is carried out for the encoded image obtained after the encryption process. Then the compressed image is decompressed in the decompression process. Finally the decompressed image is decrypted by the authorized user through decryption process. The output image obtained after the decryption process is represented in the following fig. 4 (c).

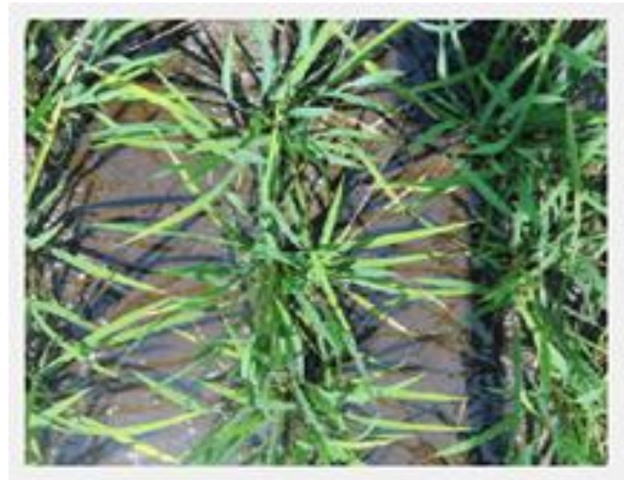

Fig. 4. *(c) Decrypted Image*

COMPRESSION RATIO

Fraction of actual size and the compressed size of image is referred as the compression ratio. And by using the formula mentioned below, the value of the compressed ratio can be calculated.

$$Compression\ Ratio = \frac{original\ size\ of\ image}{compressed\ size\ of\ the\ image} \quad (3)$$

Fig.4. *(d) Decompressed image*

4.2 PERFORMANCE ANALYSIS

Performance Analysis is carried out for the crop images that are taken as the input by means of calculating PSNR, Compression ratio and Encoding time.

TABLE 1 *PERFORMANCE STUDY FOR THE PROPOSED METHOD*

Image	PSNR	Compression ratio	Encoding time
Im1	34.0396	65.89	5.57
Im2	33.6052	66.02	5.14

Im3	34.1584	68.01	5.02
Im4	34.6614	65.45	4.98

From the above table, the values of PSNR, compression ratio and encoding time for the images 1, 2, 3 and 4 are calculated separately. Finally it can be confirmed that the image 4 exhibits improved performance by means of higher value of PSNR and lower encoding time.

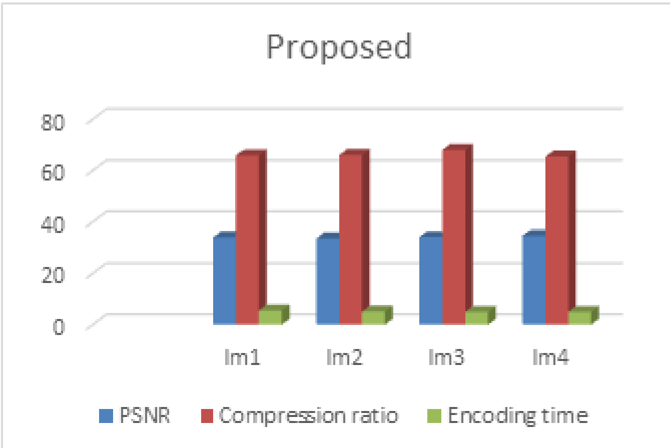

***Fig. 5**. Performance analysis of the proposed method*

The above table 1 is represented in the form of graph in the above fig. 5. Images from 1 to 4 are indicated in the X-axis and similarly the performance metrics like PSNR, compression ratio and encoding time are indicated in the Y-axis. The below table 2 gives the overall comparison of the performance of proposed method with the existing and the classic method [15]. The performance is evaluated by calculating the values of different performance measures like PSNR, compression ratio and the encoding time.

***TABLE 2** COMPARISON OF THE PROPOSED METHOD WITH THE EXISTING AND CLASSIC METHOD*

	Proposed			Existing			Classic method		
	PSNR	Compression ratio	Encoding time	PSNR	Compression ratio	Encoding time	PSNR	Compression ratio	Encoding time
im1	34.0396	65.89	5.57	30.8938	63.2436	6.69	26.24	10.1	65
im2	33.6052	66.02	5.14	30.4594	63.2584	6.54	24.14	10.1	65
im3	34.1584	68.01	5.02	31.0126	64.9479	6.3387	26.89	10.1	65
im4	34.6614	65.45	4.98	31.5156	62.9904	6.214	25.07	10.1	65

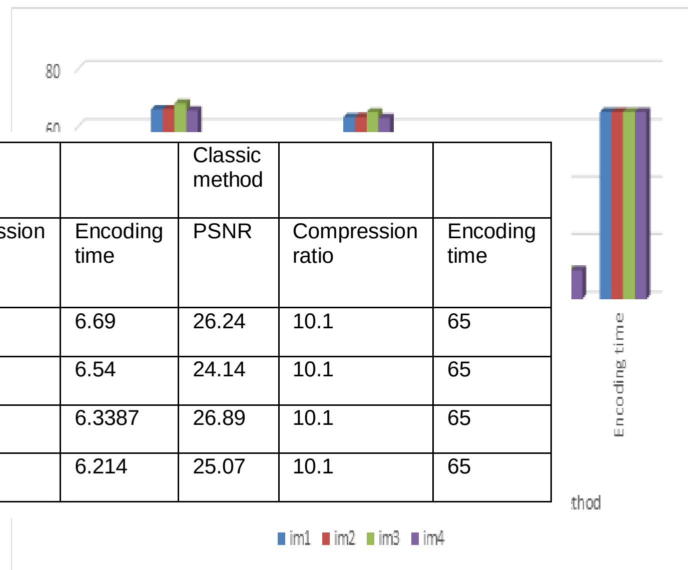

***Fig 6.** Comparative Analysis of the proposed method with the existing and the classic method*

Table 2 is represented in the graphical format in the above fig. 6. The comparative analysis of the proposed method is made by comparing the performance of the proposed method with the existing method and classic method. The input images from images 1 to 4 are indicated in the X-axis and the performance metrics like PSNR, compression ratio and the encoding time are indicated in the Y-axis.

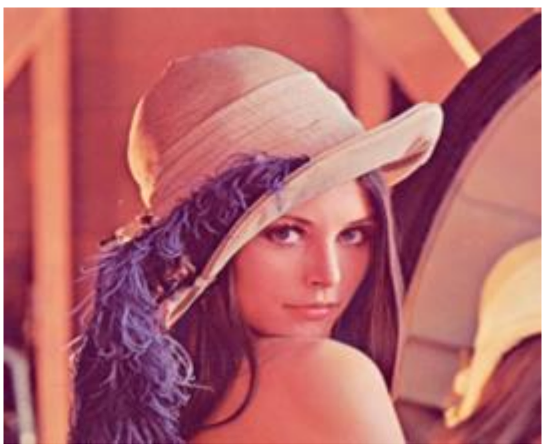

Fig. 6 *Lena Image*

Fig. 6. indicates the Lena image for which the comparative analysis is performed in the upcoming part.

TABLE 3 *COMPARATIVE ANALYSIS FOR LENA IMAGE*

Performance measures	Classic method	Existing	Proposed
PSNR	24.92	30.44	34.11
Compression ratio	10.1	63.39	66.3425
Encoding time	61	3.973	5.1775
SNR	9.2	12.69	15.56
MSE	79.24	59.11	44.31

The comparative analysis for the Lena image is obtained from Table 3. Different performance metrics like PSNR, Compression ratio, encoding time, SNR and MSE are calculated for the Lena image.

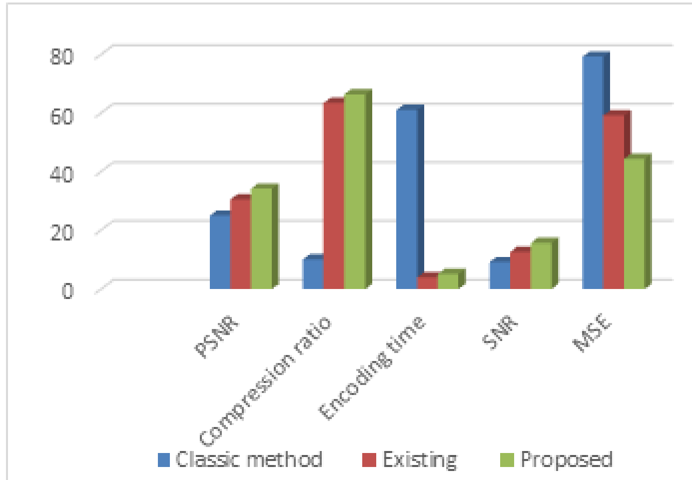

Fig. 7. *Comparative Analysis for Lena Image*

Similarly, Table 3 is represented in the form of graphical representation in the above fig. 7. The classic method, existing method and the proposed method are indicated in the X-axis while the various performances are indicated in the Y-axis. It is confirmed that the performance of the proposed method overcomes the performances of existing and classic methods. About 12.06% of PSNR value is improved when comparing with other existing techniques and 4.65% of compression ratio is increased when comparing with other methods. Similarly about 23.26% of the encoding time is decreased when comparing with other methods.

5 CONCLUSION

The crops present in the agricultural farm land are captured. The captured images are secured by performing encryption and compression. In this research work, the encryption is performed by making use of an innovative Multikey Adaptive Homomorphic Encryption (MKAHE) algorithm and similarly the compression is carried out with the help of the novel Quantized Fraction Wavelet Compression (QFWC) algorithm. After this the compressed image is decompressed and proceeded further for the decryption process. The performance of the final decrypted image is calculated based on the performance metrics like PSNR, MSE, compression ratio and encoding (i.e.) encryption time. The results of the proposed method is compared with those of the existing and the classic method. And from the results obtained after the comparison, it can be inferred that the proposed method possess increased values of PSNR by 12.06% and increased compression ratio of 4.65% and reduced value of encoding time by 23.26%when comparing with the classic and existing methods.

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