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Triple Wrapping Feature

Detection Algorithm in Manet

Highlights

Feature and their Comparison

Image Compression Technique

Discovering Thoughts, Inventing Future

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An Enhanced Wavelet based Image Compression Technique

By Teena Hadpawat & Naveen Choudhary

College of Technology and Engineering, India

Abstract- With the fast expansion of multimedia technologies, the compression of multimedia data has become an important aspect. Image compression is important for efficient storage and transmission of images. The limitation in bandwidth of wireless channels has made data compression a necessity. Wireless channels are bandwidth limited and due to this constraint of wireless channels, progressive image transmission has gained much popularity and acceptance. The Embedded Zerotree Wavelet algorithm (EZW) is based on progressive encoding, in which bits in the bit stream are generated in order of importance. The EZW algorithm, code all the frequency band of wavelet coefficients as the same importance without considering the amount of information in each frequency band. This paper presents an enhanced wavelet based approach to overcome the limitation of the Embedded Zerotree Wavelet (EZW) algorithm. This method divides the image into some sub-blocks.

Index Terms : *MEZW, wavelet, image compression methods, run length encoding, PSNR, entropy.*

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An Enhanced Wavelet based Image Compression Technique

Teena Hadpawat [α] & Naveen Choudhary [σ]

Abstract- With the fast expansion of multimedia technologies, the compression of multimedia data has become an important aspect. Image compression is important for efficient storage and transmission of images. The limitation in bandwidth of wireless channels has made data compression a necessity. Wireless channels are bandwidth limited and due to this constraint of wireless channels, progressive image transmission has gained much popularity and acceptance. The Embedded Zerotree Wavelet algorithm (EZW) is based on progressive encoding, in which bits in the bit stream are generated in order of importance. The EZW algorithm, code all the frequency band of wavelet coefficients as the same importance without considering the amount of information in each frequency band. This paper presents an enhanced wavelet based approach to overcome the limitation of the Embedded Zerotree Wavelet (EZW) algorithm. This method divides the image into some sub-blocks. The sub image with low frequency, containing higher amount of information is compressed lossless by DPCM method, and the modified EZW (MEZW) coding and Run Length Encoding (RLE) methods are used to compress the sub-images with high frequency. Higher information part is compressed by a lossless method can result in the improved PSNR. The high frequency content of the image is less important, compressed using lossy method MEZW. The Modified EZW algorithm generates less Zerotree root symbol (Z) in comparing to EZW. Run Length Encoding (RLE) is used, to use the correlation in the coded symbols. This method can ensure that makes the best use of the hierarchical relationship of wavelet coefficients and can also improve the PSNR.

Index Terms: MEZW, wavelet, image compression methods, run length encoding, PSNR, entropy.

I. Introduction

Looking back through the previous years, we can see the marvelous advancement in digital media. This kind of environment gives birth to attractive applications in multimedia. Fast and instant availability of images shows the achievements of technology in the field of multimedia. Data compression is necessary in every field where data travels across the network. Today's massive use of images, generates a significant volume of data. It is required to compress these digital images, so that their transmission and storage can be simplified. Techniques to compress the image can be lossy and lossless. Lossless techniques reconstruct the actual image at the receiver side, i.e. no loss of the information. Lossless compression [21] is required in medical images, technical writing or in clip arts. The second technique is the lossy one. In this, the image at receiver side is not the same as sender side. There is always some loss of information. Lossy compression tends to increase the compression ratio while somehow compromising the quality of the image.

For still image compression, popular and well adapted algorithm is JPEG [17] standard. Similarly, MPEG [18] standard is used for video compression. Both JPEG and MPEG make use of transform coding, i.e. DCT [8] Discrete Transform. In this type of transforming only spatial correlation of the pixels inside the single 2D block is considered and the correlation from the pixels of neighboring blocks is neglected. It is extremely difficult to décor relate the blocks at their boundaries using DCT. Undesirable blocking artifacts affect the reconstructed images of video frames.

An alternative of DCT is Discrete Wavelet Transform (DWT) [1]. This wavelet transform is able to remove the artifacts of DCT and still producing the compression ratios compatible to DCT.

Wavelets are being used in many compression algorithms. Most widely used wavelet based image compression algorithms are Shapiro's EZW [2], SPIHT (Set Partitioning in Hierarchical Trees) [11], SPECK (Set Partitioning Embedded Block) [19]. These algorithms which are based on embedded coding create an embedded binary flow, a progressive data transmission that allows the image to be reconstructed using various compression ratios, allowing the algorithm to be either lossy or lossless [20].

Several modifications of Shapiro's EZW [2] algorithm have been proposed till now. The authors in [9], gives some improvements in the implementation, they used four symbols, different than the original EZW [2]. In [10], the same coefficients used by [9] and compression scheme adopted for video compression are proposed. In [12], a degree-k model, in order to quantify the coding power of zero trees in wavelet based image coding is introduced, [12] deduced that the EZW [2] is degree 0 zero tree and the SPIHT is degree 2 zero tree. It is concluded that the higher degree zero tree coder is more powerful. In [3], author presents a modification of EZW [2] algorithm. It uses six symbols to encode the wavelet coefficients instead of four symbols, which are used in the original one. It further includes binary regrouping of elements to optimize the coding.

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Following the inspiration from [2], the principle of the Shapiro algorithm is reviewed (Sect. 2). In Sect. 3, the Modified EZW (MEZW) [3] algorithm is described in detail. In Sect. 4, the proposed algorithm is described in detail. In Sect. 5, results obtained with the proposed algorithm are analyzed and compared with results from MEZW [3] algorithm and DPCM [5] algorithm.

II. Shapiro's Ezw Algorithm

The Embedded Zero tree Wavelet (EZW) [2] algorithm is based on embedded encoding. Embedded encoding is also called as progressive encoding. This means that when more bits are added to the bit stream, the image will contain more detail. The EZW algorithm uses embedded encoder, an embedded encoder can terminate the encoding at any point, thereby allowing a target rate or target accuracy to be met exactly.

The EZW algorithm [2] has the following features.

1. Discrete wavelet transform [1]
2. Zero tree coding of wavelet coefficients
3. Successive-approximation quantization (SAQ)
4. Adaptive arithmetic coding [14]

The EZW encoder is based on these two important observations:

1. Natural images in general have a low pass spectrum. When an image is wavelet transform, the energy in the sub-bands decreases with the scale goes lower (low scale means high resolution), so the wavelet coefficient will, on average, be smaller in the lower levels than in the higher levels.
2. Large wavelet coefficients are more important than small wavelet coefficients.

These two observations are utilized by encoding the wavelet coefficients in several passes as EZW algorithm is a multiple pass algorithm. For every pass or iteration a threshold is chosen against which significance of all the wavelet coefficients is measured. Shapiro's encoder exploited possible dependence protocols between the different sub bands in order to create the zero trees. A zero tree is a data structure, composed of a parent and its descendants. In zero tree, for each parent at the scale i, there are four descendents at scale i-1 (Fig.1).

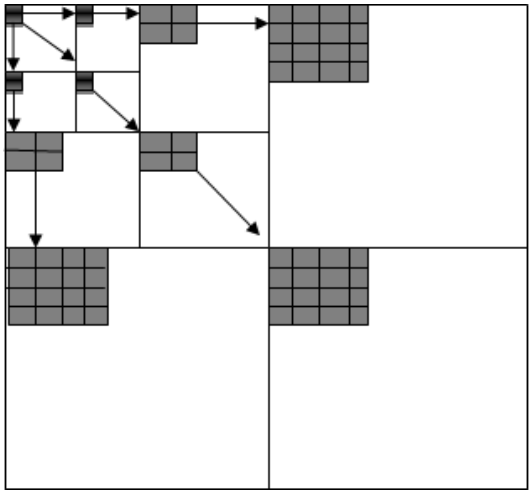

Figure 1 : Parent-descendant dependencies between sub bands

To make the "zero tree" effective, the wavelet coefficients are scanned for the path presented in Fig. 2. No child node is scanned before its parent node.

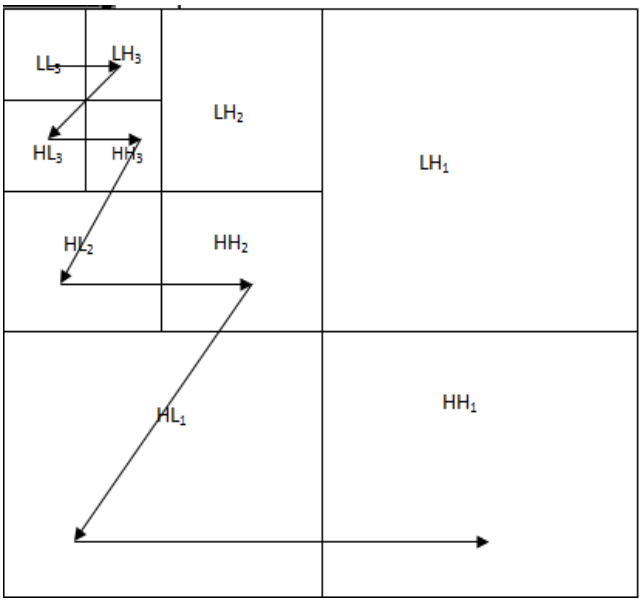

Figure 2 : Scanning order of the sub bands for encoding a significance map

Coding of wavelet coefficients is performed by determining the two lists of coefficients, i.e. dominant pass list and a subordinate list (fig. 4). Let us consider the matrix test (Fig.3) in terms of the steps of EZW algorithm [2].

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63	-34	9	10	7	-13	12	7
-31	23	-14	-13	3	4	6	1
15	14	3	-12	5	-7	3	9
-9	-7	-17	8	4	-2	3	9
-5	9	-1	47	4	-6	-2	2
3	0	-3	2	2	-2	0	4
2	-3	6	4	3	6	3	6
5	11	5	6	0	3	-4	4

Figure 3 : Example of decomposition to three resolutions for an 8 × 8 matrix

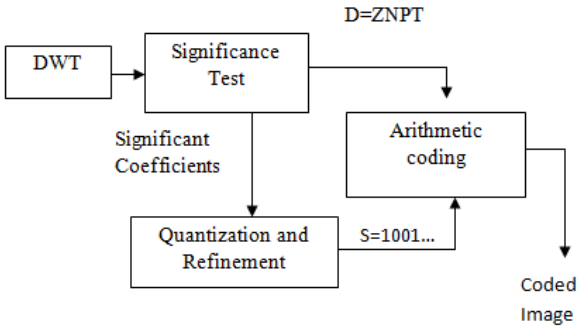

Figure 4 : Principle of Shapiro's EZW algorithm for a compression cycle

a) Initialization

The wavelet transform is applied to the image and initial threshold is calculated. T_o , the initial threshold is calculated using

$$T_0 = 2^{\log_2(|c_{\max}|)}$$

Where c_{max} is a maximum wavelet coefficient. For the test matrix, in fig. 3, initial threshold calculated is 32 and c_{max} is 63.

b) Significance Test

The wavelet coefficients are scanned for the path presented in Fig. 2. Each coefficient is assigned a significance symbol (P, N, Z or T), by comparing each coefficient with the actual thres hold T_j , where *j* is the iteration count):

- *P (Positive and Significant):* If a coefficient is greater than the threshold then it is called significant. If the sign of the significant coefficient is positive, then this coefficient will be coded as P. This is the case for the coefficients {63, 49 and 47} in the matrix test (Fig. 3)
- *N (Negative and Significant):* If a coefficient is significant with a negative sign, then it is coded with N symbol. This is the case for the coefficient {-34} in the matrix test (Fig. 3).
- *T (Zero tree):* If the coefficient is insignificant and has only insignificant descendants. Like coefficient {24} in matrix test. The descendants of this type of coefficients will not be coded.
- *Z (Isolated Zero):* The coefficient is insignificant but has some significant descendants then it is coded isolated zero Z symbol. This is the case for the coefficients {-31 and 14} (Fig.3).

The dominant list D contains information concerning the significance of coefficients, which will be coded using arithmetic coding. The significant list S contains the amplitude values of the significant coefficients, which will undergo uniform scalar quantization followed by arithmetic coding.

c) Successive Approximation Quantization and Refinement

The significant values {63,-34,49 and 47} from the matrix test (fig. 3) are quantized by the bits "1 0 1 0" [2]. Then, step B of the algorithm is repeated by incrementing j by 1 and dividing threshold by 2. This process is reiterated until the desired quality of the reconstructed image is reached orbit budget is exhausted. [2].

III. Modified Ezw [3]

A modified version of traditional Embedded Zero tree Wavelet encoding names MEZW [3]. In general [3] modified the EZW [2] in the following manner:

1. Symbols were added in the significance test step (step B). More symbols allow a better redistribution of the entropy.
2. Coding of the dominant list D elements and subordinate list S quantization bits was optimized by the binary regrouping of elements.

Let us consider the matrix test shown in Fig. 3, in terms of the steps of MEZW algorithm. Initialization step will be same as the EZW [2] algorithm, initializing the threshold by T0

a) Significance Test

The wavelet coefficients are scanned for the path presented in Fig. 2. Each coefficient is assigned a significance symbol (P, N, Z, T, P_t and N_t), by comparing each coefficient with the actual thres hold $\left(T_j = T_o/2^j\right)$, where *j* is the iteration count):

- If a coefficient is greater than the threshold then it is called significant. If a coefficient is tested and found to be significant, its descendants must also be tested. If at least one descendant is significant the it

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is encoded as P or N symbol. If the sign of the significant coefficient is positive, then this coefficient will be coded as P.

- This is the case for the coefficients {63, 49 and 47} in the matrix test (Fig. 4).
- If the coefficient is greater than the threshold and its sign is negative then this is coded as N. This is the case for the coefficient {−34} in the matrix test (Fig. 4).
- If a coefficient is less than its threshold value, then it will be considered as insignificant coefficient. If a coefficient is insignificant, then its descendent must be tested. If all of its descendants are insignificant, then it is encoded as a Pt or Nt symbols. If the symbol is positive, then the coefficient is coded as Pt symbol. This is the case for the coefficient {49} in the matrix test (Fig. 4).
- If the symbol is positive, then the coefficient is not coded as a symbol.
- If a wavelet coefficient is insignificant and all of its descendants are also insignificant, then it is coded as a zero tree T symbol. Like coefficient {23} in the matrix test (Fig. 4)
- The coefficient is insignificant but has some significant descendants then it is coded isolated zero Z symbol. This is the case for the coefficients {-31 and 14} (Fig.4).

By applying the MEZW to the matrix in Fig. 4 for the first iteration, we obtain the following results:
D : PNZT Pt TTTTZTTTPTT
S: 1010

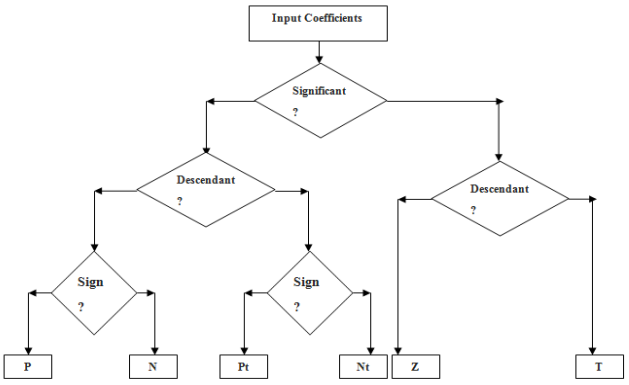

Figure 5 : Flow chart to decide Encoded Symbol

Then the both lists will go into arithmetic coding to construct coded image.

IV. Proposed Method

As we know, after the wavelet transform of the image [1], the energy is concentrated in the low frequency part of the image. Most of the information is present in the low frequency part only. The traditional Embedded Zerotree Wavelet [2] coding approach, code all the frequency band of wavelet coefficients as the same importance without considering the amount of information in each frequency band. There is no difference if the sub band is a low frequency band or a high frequency band. Our proposed technique overcomes this limitation of EZW algorithm. This method divides the image into some sub-blocks. The sub image with low frequency, containing higher amount of information is compressed lossless by DPCM method. Lossless compression of the lower frequency sub band will increase the Peak Signal to Noise Ratio (PSNR). The modified EZW (MEZW) [3] coding and Run Length Encoding (RLE) [6] methods are used to compress the sub-images with high frequency (fig. 5). The high frequency content is less important, compressed using lossy method MEZW. The Modified EZW algorithm generates less Zero tree root symbol (Z) in comparing to EZW. RLE [6] coding for the use of this kind of relevance precisely.

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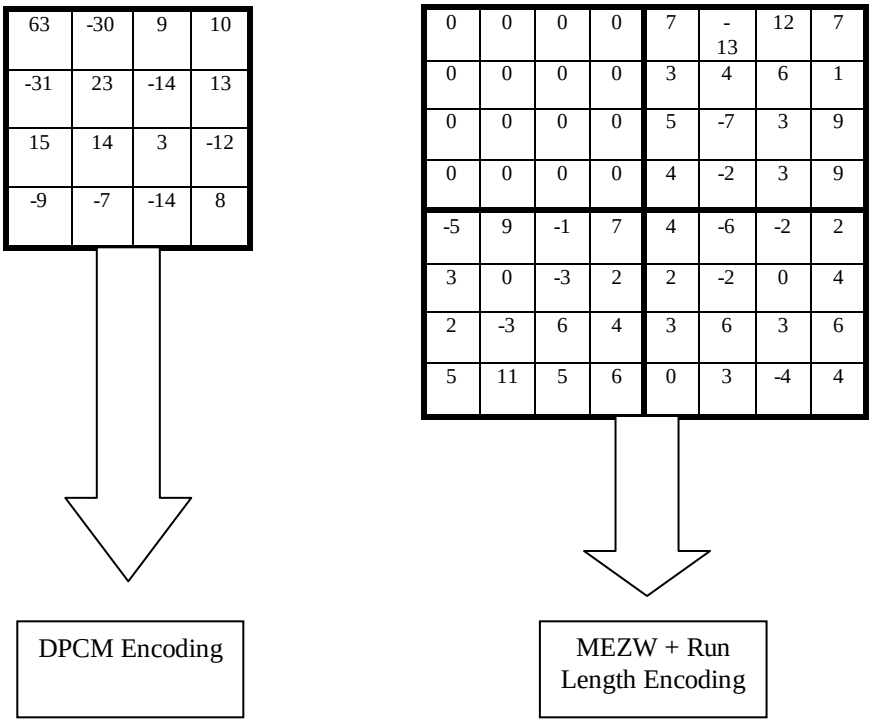

Figure 6 : Basics of Proposed algorithm

V. Simulation Results

Lena image [2] is used as the test image. The Lena image of resolution 256 * 256. The bit depth of the image is 8 bits per pixel. First of all, using Haar wavelet for lifting decomposition of the image and then using the proposed method of compression. The quality of reconstruction image is calculated in terms of a parameter called peak signal to noise ratio (PSNR). PSNR (dB) performance and compression ratio (CR) performance is calculated using the following formulae.

$$PSNR(dB) = 10\log_{10}\left[\frac{255^2}{MSE}\right]$$

Here, the mean square is:

$$MSE = \frac{1}{n \times m}\sum_{i=1}^{n}\sum_{j=1}^{m}\left(x_i - y_j\right)^2$$

Where n, m is the image size, xi the initial image and yj the reconstructed image.

$$CR(bpp) = \frac{number\_of\_coded\_bits}{n \times m}$$

Compression results of the proposed approach are compared with the MEZW [3] approach and DPCM [5] algorithm.

Table I.

Scan Times	MEZW Algorithm	Proposed Algorithm				
	PSNR(dB)	PSNR(dB)				
		LL	HL	LH	HH	Average
5	22.35	13.48	37.65	46.71	62.41	40.06
7	25.34	13.48	42.83	53.84	70.38	45.13
9	28.84	13.48	44.83	61.90	77.72	49.48

Figure 7 : Comparison of MEZW and Proposed approach in terms of PSNR

Table II.

Scan Times	DPCM Algorithm	Proposed Algorithm				
	PSNR(dB)	PSNR(dB)				
		LL	HL	LH	HH	Average
5	18.61	14.63	19.92	24.49	28.48	21.88
7	18.61	17.83	19.92	24.49	28.48	22.68
9	18.61	22.00	19.92	24.49	28.48	23.72

Figure 8 : Comparison of DPCM and Proposed approach in terms of PSNR

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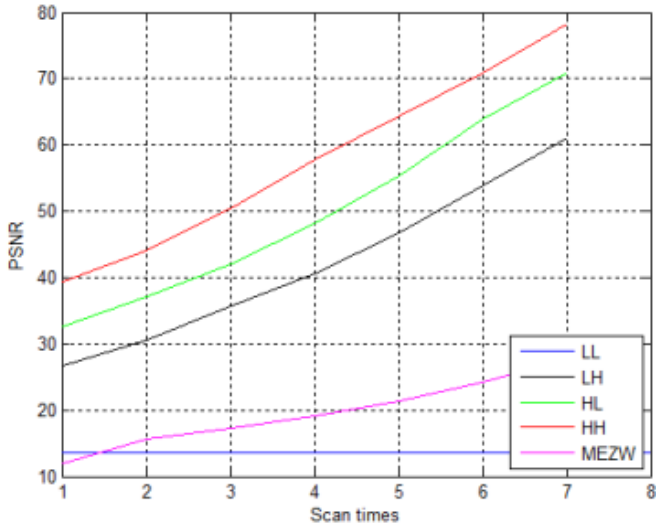

Figure 9 : Comparison of PSNR at different sub bands using a lena image [2]

The results obtained by proposing algorithm indicate that the use of sub band decomposition and different compression methods for different sub band of the image results in a significant increase in the signal to noise ratio of the image. The proposed algorithm is compared with MEZW [3] algorithm (fig. 6). With each iteration or scan pass the PSNR is increasing. For each scan pass proposed algorithm results in an approximate 20 dB large PSNR in comparing to MEZW [3]. Comparison of PSNR of different sub bands and MEZW [3] algorithm is presented in fig. 8. When comparing to DPCM [5] algorithm (fig. 7), there also increases in the PSNR value, but is less in comparison to previous comparison. Compression ratio is large for the proposed technique. After each pass, value of compression ratio increase, so as the PSNR.

VI. Conclusion

As the amount of information content is different for each frequency sub band of the image, in this paper, we proposed an image compression algorithm based on the high and low frequency distribution of wavelet coefficients. The results are compared to conventional DPCM and MEZW [3] approach for PSNR, resulting in improved PSNR. So we conclude that we use a different compression technique for each sub band, according to the amount of valuable information in the particular band. This will allow us to use the lossless technique for a crucial part of the image, results in an increased PSNR. We also find an approximated range, between twelve to fourteen, there is a negligible change in the PSNR of different sub bands.

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High Security by using Triple Wrapping Feature and their Comparison

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Abstract- In the age of information, cryptography is a predominant obligation for the security of our documents. Cryptography inclusive of authentication, integrity, confidentiality and non-repudiation has lot to offer. To protect users' information and their data from being attacked, encryption and digital signature algorithms could be utilized with distinct approaches to administer secure network and security solutions. In the current scenario, encryption alone cannot withstand the novel attacks; for notable security, we require encryption with digital signature. In this paper symmetric, asymmetric algorithm and digital signature techniques are proposed to elevate security. ElGamal encryption algorithm, ElGamal digital signature algorithm and IDEA algorithms are employed in the proposed methodology.

Keywords : *digital signature, elgamal algorithm, encrypt-sign, encrypt-sign-encrypt, idea algorithm, sign-encrypt, sign-encrypt-sign.*

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High Security by using Triple Wrapping Feature and their Comparison

Pooja Lal Mundaniya [α] & Naveen Choudhary [σ]

Abstract- In the age of information, cryptography is a predominant obligation for the security of our documents. Cryptography inclusive of authentication, integrity, confidentiality and non-repudiation has lot to offer. To protect users' information and their data from being attacked, encryption and digital signature algorithms could be utilized with distinct approaches to administer secure network and security solutions. In the current scenario, encryption alone cannot withstand the novel attacks; for notable security, we require encryption with digital signature. In this paper symmetric, asymmetric algorithm and digital signature techniques are proposed to elevate security. ElGamal encryption algorithm, ElGamal digital signature algorithm and IDEA algorithms are employed in the proposed methodology. Comparisons between encrypt-then-sign, sign-then-encrypt, encrypt-sign-encrypt and sign-encrypt-sign techniques are performed and the outcome reveals that sign-encrypt-sign technique is more robust.

Keywords: *digital signature, elgamal algorithm, encrypt-sign, encrypt-sign-encrypt, idea algorithm, sign-encrypt, sign-encrypt-sign.*

I. Introduction

Security for confidential data is required by innumerable organizations across the Globe, and cryptography fulfils this fundamental in different ways. It contributes confidentiality, integrity, authentication and non-repudiation of data. Cryptography is divided into two parts, namely symmetric and asymmetric cryptography. In symmetric (or secret key) cryptography, a single key is required for both encryption as well as for decryption. A problem of key sharing emanates from this single key, as the same key is required for decryption. Nonetheless, it has an advantage of speed. A serious concern is that there may be a chance that an enemy (attacker) can discover the secret key during transmission. While in asymmetric (public key) cryptography, two different keys are used, one for encryption i.e. public key and another key (private key) for decryption. It solves the problem of key sharing, but engenders the problem of low speed.

For encryption, the optimal solution is to fuse public-key and secret-key systems in order to get both, the security and speed. This solution is called hybrid security. In our proposed paper, Encrypt-Sign-Encrypt (ESE) and Sign-Encrypt-Sign (SES) triple wrapping techniques are employed, and it is established that they are better and more secure than encrypt-then-sign and sign-then-encrypt techniques. In the sign-then-encrypt (SE) technique, a recipient can decrypt the message, followed by re-encrypting it with the signature intact and send it to a third party. As a consequence, that third party will believe the original author sent the message directly to him, while it was actually forwarded by the original recipient. In Encrypt-then-sign (ES) technique, an attacker can remove the signature, replace it with his own, and claim authorship of the message without knowing its contents. To overcome both the above problems, a novel technique is proposed, namely Encrypt-Sign-Encrypt (ESE) technique. In this ESE technique, double encryption is performed and the results demonstrate it to be more secure when compared to ES and SE. However, it has disadvantage of high computational time and computational cost. This computational time and cost is reduced by another proposed technique called Sign-Encrypt-Sign (SES). SES is also secure with an advantage that it requires less time and computational cost. The remainder of this paper is organized as follows: In section 2, brief description of hybrid cryptography is given. In the next section related work is presented. Section 4 presents the proposed scheme and is analyzed in detail. Section 5, comparison of proposed methodology with ES and SE is given, section 6 gives results and discussion and finally conclusions and future work are presented in the last section based on the implementation.

II. Hybrid Cryptogrpahy

Hybrid encryption is a mode of encryption that merges two or more encryption systems. It incorporates a combination of asymmetric and symmetric encryption to benefit from the strengths of each form of encryption. These strengths are respectively defined as speed and security. Hybrid encryption is considered a highly secure type of encryption as long as the public and private keys are fully secure. Digital signature is used to validate that the message was created by authorized sender, such that the sender cannot deny having sent the message and that the message was not altered in transit. The notion of a digital signature is useful and is a legal replacement for handwritten signature. Encryption and digital signature techniques are fundamental in any cryptographic tool for privacy of the data and authenticity respectively. Hybrid-key cryptosystem and digital signature, which is more secure and the security

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relies on the problem of solving discrete logarithms and on factorization [1]. The hybrid scheme may use encrypt-then-sign or sign-then-encrypt technique. In this proposed work, triple wrapping feature is put to use by implementing Encrypt-Sign-Encrypt and Sign-Encrypt-Sign techniques. These proposed techniques are expected to be more secure in comparison to the existing techniques but at the cost of extra overhead.

III. Related Work

In [1] encrypt-then-sign scheme is proposed. In this IDEA-RSA algorithm is used for hybrid encryption and RSA digital signature algorithm is used to obtain digital signature. The end result shows that hybrid cryptographic scheme can be used for fast encryption and digital signature jointly and achieved speed of 2.8 Mbps which is faster than the existing implementations. This scheme is applicable in secure internet computing, e-payment in distance education system as well as in a mobile environment, because the overall computational cost is low. This scheme is also advantageous for mobile devices like smart card based applications and many other applications.

In [5] a new deniable authentication protocol based on the generalized ElGamal signature scheme is proposed, and has two characteristics:

1. It enables an intended receiver to identify the source of a given message.
2. The intended receiver cannot prove the source of a given message to any third party. This new protocol needs less computation and communication time. Moreover the new protocol is on-interactive. Therefore, the new protocol is more efficient.

In [3], author solves the problem of key management and database encryption in the implementation process of the database encryption system. Some difficult technology of encrypt / decrypt engine in the implementation process is discussed, the hybrid cryptography encryption program is presented based on IDEA combined with RSA, and the encryption system is designed and realized. The key management module is responsible for encryption key generation, distribution, updating and storage, and is the core of the database encryption system. This shows that, new program can solve problems and make the whole encrypted database system work effectively.

In [10] an improved version of ElGamal signature algorithm for better security is proposed and this makes the ElGamal digital signature algorithm more adaptable and extensive use of digital signatures to provide security guarantees. It reduces the overall operation, and also saves storage space. Moreover the proposed method can be applied with the specific role of a particular digital signature system, to upgrade its attack against the resilience of random numbers.

In [8] hybrid cryptography algorithm is designed for better security by combining two symmetric cryptography techniques Data Encryption Standard (DES) and International Data Encryption Standard (IDEA). This hybrid algorithm has high security of data transmission over the network. This work results into more secure transmission of data comparatively DES, IDEA and AES data encryption algorithms. As both symmetric algorithms are used for hybrid cryptography security, the computational process used for encryption and decryption of the plaintext and ciphertext is essentially same.

The existing techniques videlicet Sign-then-Encrypt and Encrypt-then-Sign fails some security parameters as shown in Table 1. In SE, the recipient can decrypt the message, then re-encrypt it with the signature intact and send it to a third party. In ES, any attacker can remove the signature, replace it with his own, and claim authorship of the message without knowing its contents. To overcome both problems new (triple wrapping) ESE and SES methods are proposed which uses hybrid security, mixture of symmetric and asymmetric cryptography which solves the problem of key transmission and speed respectively. These proposed methods prove to be more secure as compared to existing techniques.

IV. Proposed Methodology

In this proposed methodology, various issues in hybrid cryptography are analyzed and are improve for better security. Hybrid cryptography combines two or more encryption systems to achieve effective security, but as new techniques appear; the attacker generates new attack. In this paper, two techniques are proposed ESE and SES, and they take advantage of the triple wrapping feature. In ESE – double encryption is implemented. In the first stage of encryption, plaintext is encrypted followed by the second stage where the sender's signature is also attached. In SES – sender's private key is used firstly to sign the message (plaintext) and then the encrypted message (ciphertext). These proposed techniques turn out to be secure and are improved alternative to sign-then-encrypt and encrypt-then-sign techniques. These novel techniques use IDEA algorithm for message encryption, ElGamal encryption algorithm for encrypting IDEA key and ElGamal digital signature algorithm for generating digital signature. Figure 1 and 2 shows the block diagram of ESE technique for encryption and decryption respectively.

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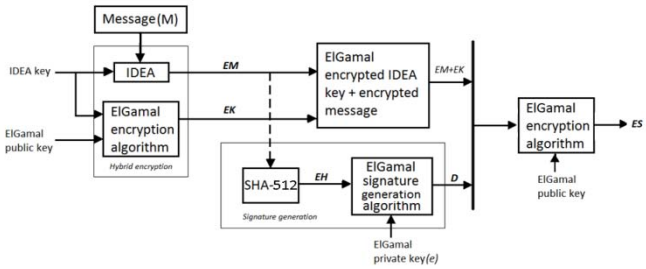

Figure 1 : ESE Encryption

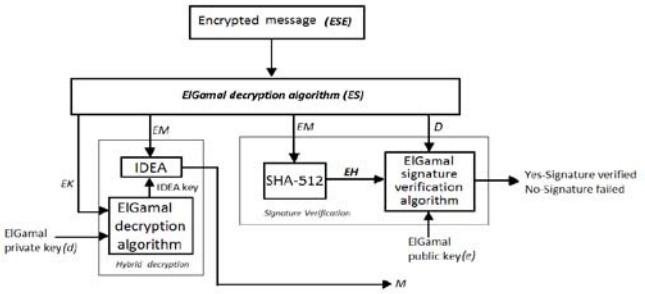

Figure 2 : ESE Decryption

Figure 3 and 4 shows the block diagram of SES technique for encryption and decryption respectively.

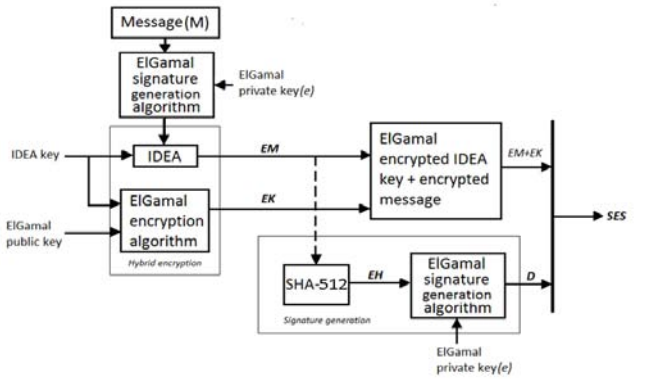

Figure 3 : SES Encryption

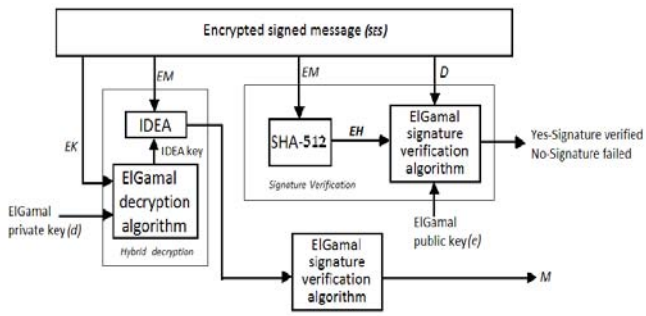

Figure 4 : SES Decryption

V. Comparison of Proposed Methodology with ES and SE Methods

Comparison is done on the basis of security parameters, computational time and cost. Two types of attacks are considered in proposed work videlicet third person attack and receiver attack. Both attacks are applied on existing methods as well as proposed methods and on this basis, security parameters are evaluated as shown in table 1, and the results establish that the proposed methodologies are more secure.

1. *Third Person Attack*

In this attack, any third person (or man-in-middle) can undertake the attacker work, and vandalize our information. In Encrypt-then-Sign and Sign-Encrypt-Sign techniques, the attacker can discard outer signature and attach his own digital signature. Now, the receiver will believe that message was sent by the third person and not the original sender. In this scenario, authentication fails. Nevertheless, this outer signature has an advantage of public verifiability, which means that any person can verify the signature owing to the fact that signature's public key is open to all, and this digital signature is signed by sender's private key only.

In Sign-Encrypt-Sign technique if outer signature is changed by third person then original receiver will find out that the message has been attacked and it is not the original message, this is because the outer signature will not match the inner signature. So, SES technique is safe from this attack.

2. *Receiver attack*

In some cases if receiver becomes attacker; he can forward our signature to others. In Sign-then-Encrypt and Encrypt-Sign-Encrypt techniques, after the receiver receives the message, he decrypts it with his private key and again encrypts it (re-encrypt) and send it to the third person with our digital signature intact. That third person (new receiver) will observe that the message is sent by the original sender, but actually it has been sent by the original receiver.

SES and ESE technique are safe from both attacks, and proves secure as compare to ES and SE techniques.

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Table 1 : Security parameters table Techniques

Techniques / Parameters	ES	SE	ESE	SES
Authentication	NO	NO	YES	YES
Confidentiality	YES	NO	YES	YES
Integrity	YES	YES	YES	YES
Non-Repudiation	YES	NO	YES	YES
Public Verification	YES	NO	NO	YES

a) Sign-then-Encrypt (SE)

In this technique, the document is first digitally signed with private key of sender, and then that signed document is encrypted with hybrid encryption. Document is encrypted by employing IDEA key algorithm, and then IDEA key is encrypted with ElGamal Encryption Algorithm. This document is transmitted to the receiver. At the receiver end, SE document is decrypted with receiver's private key and with IDEA key, the encrypted message is deciphered. In this case receiver can verify that the document is transmitted by the original sender with sender's digital signature.

Problem: In above technique, if the receiver becomes intruder, the recipient can decrypt the message, then re-encrypt it with the signature intact and send it to a third party. That third party will believe that the original author sent the message directly to him, while it was actually forwarded by the original recipient. In this case, authentication fails, no public-verification and repudiation problem occurs.

b) Encrypt-then-Sign (ES)

In this technique, the document is first encrypted with Hybrid encryption technique, and then the encrypted document is digitally signed by the sender.

i. *Problem*

Any attacker can remove the signature, replace it with his own, and claim authorship of the message without knowing its contents. In this case, authentication fails, as original sender's signature is removed by third person.

c) Encrypt-Sign-Encrypt (ESE)

In this proposed technique, the document is first encrypted with hybrid technique and then digitally signed with sender's private key. Then again encryption is done on that document. This last encryption is done for better security; as a consequence outer signature cannot be replaced by third person.

i. *Problem*

In ESE the inner encryption ensures only the intended recipient can read the message. In this case, the recipient won't know the message is signed until after it's decrypted. Encrypting a message twice is more time consuming. Furthermore, encrypt-then-sign is known to be vulnerable to attack. Double encryption requires more time and no public-verification.

d) Sign-Encrypt-Sign (SES)

In this proposed technique, double signature is performed on document- one on plaintext and another on ciphertext. Here, the inner signature means the author is aware of the content. The encryption ensures only the recipient can decrypt it. And the outer signature means that the author intended the message for the recipient. If an attacker tries to claim ownership by removing the outer signature and replacing it with his own, then the (replaced) outer signature won't match the inner signature.

i. *Problem*

Computational time and cost is more as compared to ES, SE techniques but less than ESE technique.

The architecture of sign-then-encrypt approach deteriorates from forwarding attack. On the other hand, the architecture of encrypt-then-sign approach deteriorates from cipher text stealing attacks. The two-block approach has many security flaws and to alleviate those, we present the three-block approach (triple wrapping feature) i.e., Encrypt-Sign-Encrypt and Sign-Encrypt-Sign. One major drawback of three-block approach is that the cost involved in securing a message using Encrypt-Sign-Encrypt or Sign-Encrypt-Sign is the total costs of three blocks of digital signature and encryption. In addition to this, computation time for signature verification and decryption process is involved at the receiving end. All of these constitute the cost of performing cryptographic operation on a message.

SE and ES techniques have their disadvantages; these disadvantages are overcome by proposed ESE technique. ESE technique is safe from both receiver attack and third person attack. Because of double encryption ESE requires high computational time and cost. So, second technique is proposed; SES, which is as secure as ESE technique and requires very

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low time and cost as compared to ESE technique, but slightly more than ES and SE techniques.

The first graph in Figure 5 illustrates line graph for computational time between number of operations and computational time in seconds when encrypting a message. SE and ES techniques manage to decrypt the message in almost the same time. On the other hand, ESE technique requires four times the computational time required by other techniques. Our second proposed technique SES utilizes approximately the same computational time when compared to ES and SE techniques.

The second graph in Figure 5 portrays line graph for computational time between number of operations and computational time in seconds when decrypting a message. Time required by both the existing techniques videlicet SE and ES is similar. The ESE technique takes four times the computational time required by other methodologies. Corresponding to the encryption technique, the computational times utilized by SES is similar to ES and SE techniques.

The first bar graph in Figure 6 interprets comparison between the four methodologies in terms of computational costs when encrypting message. ES and SE techniques utilize equal number of operations in every case without exception. It is clear that ESE utilizes almost twice the number of *Texp* operations as compared to other techniques. The other proposed technique SES virtually exploits the same computational cost except in case of *Th* operation where it utilized thrice the number of operations when compared to ES and SE techniques.

The second bar graph in Figure 6 delineates collation between the four methodologies in terms of computational costs when decrypting message. The number of operations used by ES and SE techniques is equal in every case with the exception in *Th* where SE requires an operation less than ES methodology. Even when decrypting a message, ESE requires almost twice the number of *Texp* operations as compared to the other methodologies. Analogous to the encryption technique, SES uses about the same number of operations when compared to ES and SE techniques with the exception of *Th* operation where it utilized thrice the number of operations.

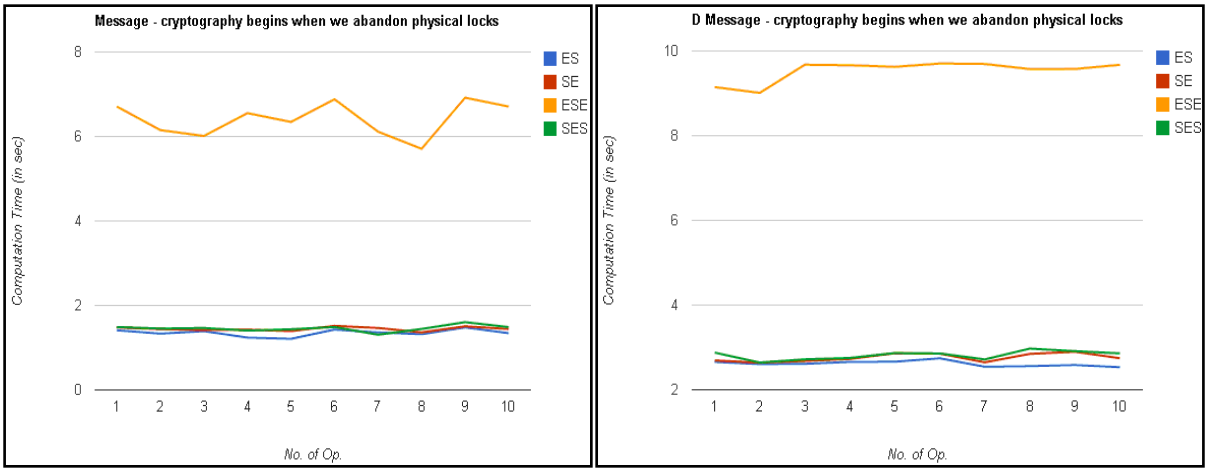

Figure 5 : Graph for computational time

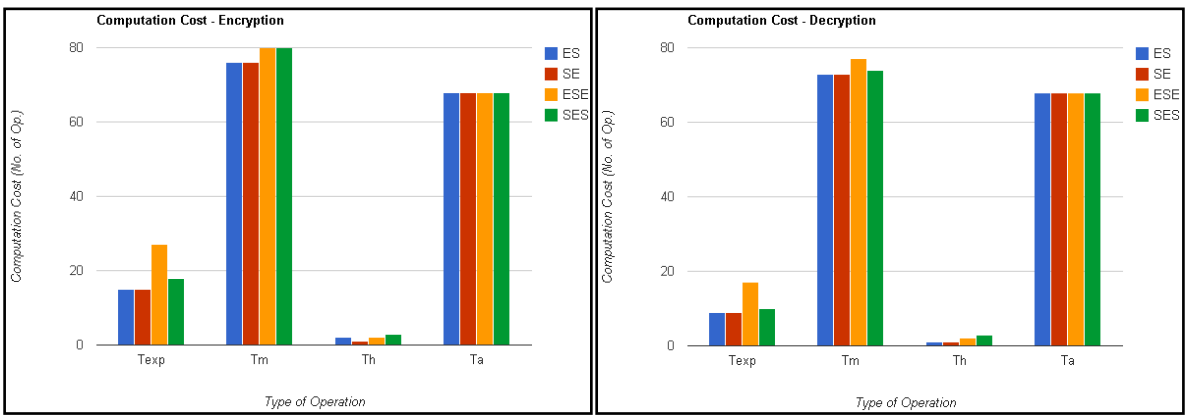

Figure 6 : Graphs for computational cost

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VI. Results and Discussion

The computational cost is evaluated by summing the number of operations (i.e. modulo, hash, multiplication, addition, exponentiation, and division (inversion)) for all schemes ES, SE, SES and ESE. The results for the same are depicted in the graph as shown in figure5 and 6. All schemes are implemented using MATLAB and executed *on a machine with a 1.73GHz Intel Dual Core processor, with 1GB installed memory.*

Security parameters of our proposed methodology such as confidentiality, authentication, integrity and non-repudiation are proves to be secure as compare to existing methods as shown in table 1. Figure 5 shows the comparison between existing techniques and our proposed ESE and SES techniques. The results show that the proposed methodology ESE requires four times more computational time for encryption and decryption as compared to existing methods. And second proposed method SES utilizes approximately the same computational time when compared to ES and SE techniques. Figure 6 shows the graph between computational cost and number of operations.

a) Where

Texp: the time for a modular exponential computation, *Tm*: the time for a modular multiplication computation, *Th*: the time for a one way hash function f(_) computation and *Ta*: the time for a modular addition / subtraction computation.

ES and SE require almost same number of operations except in case of Hash operation during encryption where ES takes 1 operation more than SE technique. Furthermore, SES methodology is not far behind and utilizes only few more operations than the existing technology i.e., for SES encryption 1 *Th*, 3 *Texp* and 4 *Tm* operations more and for SES decryption 2 *Th*, 1 *Texp* and 1 *Tm* additional operations. However, ESE encryption put to use 27 *Texp* operations which is nearly twice the number of operations when compared to 15 *Texp* operations of the existing technology and 1.5 times greater than 18 *Texp* operations of the second proposed methodology SES. Although the computational time and cost of the proposed methodology increases, it still proves to be better in terms of security parameters such as confidentiality, authentication, integrity and non-repudiation.

VII. Conclusion and Future Work

Encryption together with digital signature technique is employed to safeguard users' vital information from being compromised as encryption independently can be vulnerable to pristine attacks. Here, security is boosted by the amalgamation of symmetric-key, asymmetric-key and digital signature algorithms. To be precise, the proposed methodology exerts the merits of IDEA, ElGamal encryption algorithm and ElGamal digital signature algorithm.

In this paper, we have proposed triple wrapping feature namely Encrypt-Sign-Encrypt and Sign-Encrypt-Sign techniques and presented a comparison between the Sign-then-Encrypt, Encrypt-then-Sign, Encrypt-Sign-Encrypt and Sign-Encrypt-Sign. The proposed scheme is more secure for hybrid encryption and digital signature as compared to existing techniques ES and SE. ESE and SES demonstrates confidentiality, integrity, authentication and non-repudiation, and also SES is publically verifiable. Computational time and cost required for proposed SES technique is almost same as existing techniques ES and SE, where as proposed ESE technique requires four times more computational time when compared to ES, SE and SES. Future work can be done on SES technique to reduce computational time and cost.

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An Efficient Misbehaving Node Detection Algorithm in Manet

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An Efficient Misbehaving Node Detection Algorithm in Manet

Shaheen Bohra [α] & Naveen Choudhary [σ]

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I. Introduction

Mobile ad hoc networks are of immense importance in many scenarios where infrastructure setup is not feasible. It is of great importance in disaster management scenarios. Ad hoc networks can be setup when a group of nodes communicate with each other by forwarding each other's packet or data. Nodes communicate with each other if they are in radio range of each other. So if two nodes are not within each other's range their data is transmitted with the help of intermediate nodes. So the intermediate nodes play a key role in efficient data transmission in ad hoc networks. In ad hoc networks each node has its own resources and the most crucial resource is power. Each node tries to save its energy so that it can use it for its own transmission. And maximum amount of energy is consumed during packet transmission. So when a packet arrives at intermediate nodes, some nodes drop the packet as they don't want to waste their energy in transmission of other nodes packet. So network becomes disconnected and packet doesn't reach their destination. Such nodes in the network are called misbehaving nodes. These node reply to route request and become part of route but when the packet actually arrives, they drop the packet. Because of this the sender node again sends route request to establish another route. It may happen that the other route also contains misbehaving nodes. If such process repeats the sender assumes that it is not possible to route the packet to the destination and it drops the packet. Such nodes decrease the network efficiency. Further, if an alternative path is found which does not contain misbehaving nodes, it leads to increased delay of packet transmission.

So it is very important to detect such misbehaving nodes in the network as these nodes cause unnecessary burden on cooperative nodes. These nodes use other nodes resource and transmit their packets but don't forward other nodes packet. So their detection becomes even more important to induce fairness in the network.

II. Related Work

Buttayan and Hubaux [1][2] introduced a virtual currency method called Nuglets. In this technique a node has to pay other node for forwarding its packet. This requirement makes all the nodes interested in forwarding other nodes packet as they also need nuglets to forward their data packets. Payment of nuglets is either done by source node or destination node. The problem with this technique is that it is difficult to estimate the number of nuglets required by source node. Further the absence of central monitoring mechanism makes it even more difficult to induce fairness in the network.

Zhong and Yang [1][8] proposed an incentive based mechanism called Sprite. In this a node collects receipt for each forwarded packet. The receipt is nothing but the hash of the packet. To provide fairness in the network it has a central monitoring mechanism called credit clearance service. All the nodes send their receipt to the CCS. The CCS is responsible for providing credit to the nodes. The main disadvantage with this method is that the CCS can become a source of bottleneck.

Marti [7] proposed watchdog/Pathrater model in which overhearing technique is used to identify misbehaving nodes. When a node forwards a packet, it observes the next node to find whether it forwards the packet or not. A node is considered as misbehaving if it does not forward the packet. The misbehaving counter is incremented each time misbehavior is detected. If the counter exceeds a threshold value, that node is considered as misbehaving and is avoided by pathrater in future routes.

Buchegger and Le [1] [9] proposed a reputation based scheme called Confidant. The monitoring mechanism is based on the watchdog model. Nodes use overhearing mechanism and operate in promiscuous mode. When a node detects

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misbehavior, it notifies other nodes through the broadcast of alarm messages. The use of second hand information increases the risk of false detection.

Michiardi and Molva [1] [10] proposed Core, which uses a different reputation mechanism. It calculates a combined reputation rating. This rating is formed by direct observation, indirect observation and task specific behavior.

He and Dapeng Wu [12] proposed Sori, which also rely on watchdog mechanism. It also relies on both direct observation and second hand information. Each node maintains a neighborhood list which contains the number of packets received and forwarded by each neighbor. It also punishes the nodes which are considered misbehaving.

Soltanali [13] proposed a reputation-based scheme consisting of four modules. The Monitor module is based on the watchdog model. The opinion manager is responsible for formulating opinion regarding nodes behavior and advertises the opinion to neighboring nodes periodically. The Reputation Manager processes these opinions and derives a trust metric for a specific node. The Routing/Forwarding Manager use the trust metrics to select a routing path.

Bansal and Baker [5] proposed a reputation based method called OCEAN. This method relies on overhearing technique to find out misbehaving nodes. When a nodes rating falls below a faulty threshold it is added to faulty list. It also use second chance mechanism which allows previously considered misbehaving nodes to become active in the network again.

Balakrishnan, Deng and Varshney [4] proposed an acknowledgement based scheme. The overhearing technique monitors the sender of the next hop link which leads to false detections. So to confirm the successful packet reception this scheme makes use of a special type of acknowledgement packet called TWOACK which is send by the two hop neighbor. When a node does not receive an acknowledgement it considers the entire link to be misbehaving. So this leads to most of the nodes being unavailable for routing packets.

Roubaiey, Sheltami, Mahmoud, Shakshuki and Mouftah [14] proposed an adaptive acknowledgement AACK method which is a modified TWOACK method. It is a combination of end to end acknowledgement and TWOACK method. It uses a function to calculate the number of hops and depending on the result it either uses end to end acknowledgement or Twoack. The use of end to end acknowledgement results in reduced overhead of acknowledgement packets. And instead of detecting misbehaving links, it detects misbehaving nodes.

III. Proposed Methodology for Effecient Misbehaving Node Detection

We proposed a combination of overhearing and acknowledgement based scheme which is designed to be built on top of DSR routing protocol. Reputation based schemes such as OCEAN [5] relies on overhearing technique which face problems like ambiguous collisions, limited transmission power, limited overhearing range and false detections. The TWOACK [4] scheme solves the overhearing problems by the use of special type of acknowledgement packet termed as TWOACK. The receiver of the next hop link is responsible for sending acknowledgement to confirm successful packet receipt. But the disadvantage of TWOACK scheme is the additional overhead of acknowledgement packets. So to improve the efficiency of overhearing mechanism and reduce the overhead caused by acknowledgement scheme, we proposed a combination of overhearing and acknowledgement based method.

In this section we first describe OCEAN [5] and TWOACK [4] scheme and then we describe our proposed technique.

a) OCEAN (Observation based cooperation enforcement in ad hoc networks)

OCEAN [5] is a reputation based mechanism which relies on direct observation of nodes behavior. It is composed of five components to discover misbehaving nodes:

1. *Neighbor Watch:* It is responsible for monitoring the neighboring nodes and is based on watchdog model. It uses overhearing technique to detect node misbehavior.

2. *Route Ranker:* Every node maintains ratings for each of its neighboring nodes. Initially the rating is zero and then it is incremented or decremented according to positive or negative event observed by neighbor watch module. When the rating of node exceeds the Faulty Threshold, the node is added to the faulty list.

3. *Rank-based Routing:* It uses the information derived from the Neighbor Watch in route selection. To avoid the routes containing nodes in the faulty list, we add a variable-length field to the DSR Route-Request Packet (RREQ) called the avoid-list. The avoid list is a list of nodes that the RREQ transmitter wants to avoid in its future routes. A node appends its faulty list to the avoid list on re-broadcasting a RREQ. Any node which receives the RREQ checks the RREQ avoid list. The avoid list and RREQ route is compared to check if there is a common node. This common node is a misbehaving node. The node drops the RREQ when such misbehaving node is detected else it either sends DSR Route reply or rebroadcast the RREQ. Similarly, a DSR Route-Reply (RREP) is accepted only if the route in the RREP does not contain a node in the locally-

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maintained faulty list. Otherwise, the RREP is simply dropped.

4. *Malicious Traffic Rejection*: It rejects traffic from nodes that are considered misbehaving.

5. *Second Chance Mechanism:* It is intended to consider the nodes that were previously considered misleading to become useful again. This is useful when a well behaved node is marked as a misbehaving node.

Since OCEAN uses overhearing mechanism it is prone to problems like ambiguous collision, limited transmission power, limited overhearing range and false detections.

The monitoring mechanism of OCEAN relies on overhearing mechanism which can face problems like:

1. Ambiguous Collisions

When node A forwards packet to node B, node A start overhearing node B to check whether it forwards the packet to C. While overhearing if another node sends data to node A, node A fails to overhear node B`s transmission. This is called ambiguous collision and leads to false detection

TWOACK [4] technique solves the problem of ambiguous collision as node A will receive TWOACK [5] from node C which confirms successful packet reception.

Figure 1 : Fig showing ambiguous collision scenario

2. Limited Overhearing Range

A cooperative node B may use low transmission power to send data towards C. Since node A`s overhearing range is limited, it fails to overhear node B`s transmission and detects B as a misbehaving node. This again leads to false detection. The TWOACK [4] scheme is capable of solving limited overhearing range problem.

3. Limited Transmission Power

A node can limit its transmission power such that the signal is strong enough to be overheard by the previous node but too weak to be received by the recipient node .This would also cause false detection. This problem can also be solved by TWOACK [4] method.

b) Twoack Scheme

TWOACK [4] scheme solves the overhearing problems described above by the use of an explicit acknowledgement packet termed as TWOACK. When a node forwards a packet, it verifies that the packet is received successfully by the node that is two hops away on the source route. This is done through the use of a special type of acknowledgment packet, called TWOACK. Suppose that the source S wants to send the packet to destination D. Source S will perform route discovery process and find a route to reach the destination D.

Now suppose A forwards a data packet to B, which is to be forwarded to C, A cannot detect if the packet has reached C successfully or not. Overhearing the node B would only tell A whether B is sending out the packet or not. However, A cannot tell that C has received the packet or not. The possibility of collisions at both A and C makes the overhearing technique vulnerable to false detections. The TWOACK packet sent by node C tells node A that the data packet has successfully reached node C.

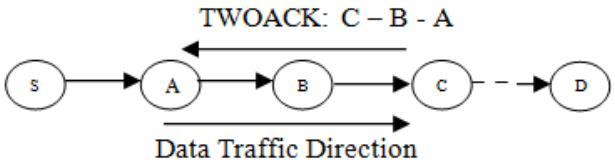

Figure 2 : Fig showing working of TWOACK scheme

Each node mantains a list of data packet ID that are yet to receive TWOACK from next to next hop. When an acknowledgement is received it removes the ID from the list. When the node does not receive acknowledgement after a timeout, it increments the misbehaving counter C_{mis} tiil the counter reaches the threshold value after which the link is marked as misbehaving. When the node detects misbehavior, it sends RERR message informing the source about detected misbehavior.

The main disadvantage of TWOACK scheme is he high routing overhead caused by TWOACK and RERR packets. High routing overhead also affects the increase in average latency of data packets. Another drawback of TWOACK technique is that it detects misbehaving links which gives misbehaving nodes more chance to drop the packets as it might be connected to other links [14].

c) Proposed Methodology

OCEAN [5] uses overhearing technique which suffers from problems like ambiguous collision, limited transmission power, and limited overhearing range. This results in false detections. The TWOACK [4] scheme is capable in solving overhearing problems and results in better detection technique.

But the TWOACK technique increases the routing overhead in the network due to broadcast of alarm message as well as acknowledgement packets.

To reduce the overhead of acknowledgement packets and improve the performance of overhearing technique we proposed a combination of overhearing and acknowledgement scheme. We modified the monitoring mechanism of OCEAN [5] method by introducing a positive threshold. The rating of node is initialized to zero in the beginning. When a node forwards the packet we increment its rating and similarly

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we decrement its rating if it drops the packet. First we start with the reliable TWOACK [4] scheme to detect misbehaving nodes. Each node while sending a packet checks the next node rating. If the rating is less than defined positive threshold, it continues with the TWOACK scheme so that we get sufficient positive evidence of nodes cooperative behavior. When the rating of node becomes equal to positive threshold it switch to overhearing technique to reduce the overhead of TWOACK scheme [4]. Each node maintains list of neighboring nodes and their rating. When node rating reaches faulty threshold we add the node to faulty list.

Each node on receiving a RREQ checks the faulty list. If the node sending the RREQ falls in the faulty list, its RREQ is simply dropped. When a node receives RREP it checks its faulty list to find if the path contains misbehaving node. If the path contains misbehaving nodes then the node does not use this path. Otherwise it sends the packet using this path.

We also use the second chance mechanism so that the nodes which were previously considered misbehaving can become active in the network again. This is useful in the case if a cooperative node is detected as a misbehaving node. The second chance rating of node is not initialized to 0 in order to prevent misbehaving nodes to further exploit the network [5]. The second chance timeout [5] should also be neither too high nor too low as high timeout will give less chance to the well behaved nodes and low timeout will allow misbehaving nodes to quickly enter the network again. So the second chance threshold is set to -30 and second chance timeout is 30. The faulty threshold should also be neither be too low nor too high. Low faulty threshold will quickly add nodes in the faulty list whereas high faulty threshold will give misbehaving node more chance to exploit the network. So the faulty Threshold is set to -40 and results are evaluated at different positive threshold.

Figure 3 gives a brief algorithm of our proposed scheme.

Initialization :

Set Increment rating = 1

Set Decrement rating = -2

Set Positive Threshold = 80

Set Faulty threshold = -40

Set Second Chance Rating = -30

Set Second chance Timeout = 30

Procedure :

1.Set tamode = TRUE

//Initially the twoack mode is set to be true

2. Packet_send (Packet)

i) For each node that sends a data packet

ii) Check the neighbor node rating

iii) If rating < positive threshold

Then continue with the TWOACK method

iv) Else

Switch to the overhearing mechanism

v) If rating < faulty threshold

Add node to Faulty list

vi) Endfor

vii) If second_chance_timeout expires

Remove node from the faulty list and initialize with second chance rating.

3. Packet_recv (Data Packet / TWOACK) // When tamode is ON the sender of the packet waits for TWOACK

i) If the received packet is a data packet

Then forward packet

ii) Else if packet received is TWOACK

Then increment next node rating

iii) If twoack timeout expires

Decrement next node rating

4. Packet_recv (Data Packet) // When tamode is OFF the sender of the packet observes the next hop using overhearing technique

i) If the next hop neighbor forwards the packet

Then increment next node rating

ii) Else if next hop neighbor drops the packet

Decrement next node rating

End Procedure

Figure 3 :Algorithm of proposed scheme

IV. Performance Evaluation

a) Simulation Methodology

The simulation is performed on network simulator ns2 with 50 mobile nodes moving in a 750×750 m^2 flat area. The transmission range of each node is 250 m. The IEEE 802.11 MAC layer and a random waypoint mobility model was assumed with pause time of 0 second is used. We used CBR traffic between pairs of nodes. The source and destination for each CBR pair are randomly chosen and there is no limit on the number of sources or destinations that a node can host. The scheme is analyzed by running simulations for networks with 10 CBR pairs. Each CBR source generates packets of size 512 Bytes, and transmits 8 packets per second. Each simulation lasts 100 seconds. 5 simulation runs (using different seeds) were used to obtain each data point. Table 1 shows the configuration parameters used by us for the simulation.

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Table 1 : Simulation Parameters for the proposed method

Parameters	Value
Number of nodes	50
Simulation Area	750 x 750 m
Mobility Model	Random waypoint model with pause time 0
Traffic Type	CBR
Packet size	512 bytes
Packet Rate	8 /sec
Maximum connections	10

We used the following performance metrics to evaluate our method at different percentage of misbehaving nodes.

1. Packet Delivery Ratio: It is defined as the number of packets that successfully reached the destination node to the number of packets sent by the source node.
2. Average Latency: It is defined as the time taken by a data packet to travel from source node to the destination node.
3. Throughput: It is defined as the number of packets successfully received by the destination node. It is measured in Kbps.
4. Routing Overhead: It is defined as the number of routing related transmission to the total number of transmissions.

b) Simulation Results and Discussions

Figure 4 shows the average latency experienced by packets in our proposed scheme at varying positive Threshold. In a network of 50 nodes, 10 nodes were misbehaving. We observed that with the increase of positive threshold the delay experienced by packets to reach the destination increases. It is due to the increase of TWOACK packets in the network as well as the switching overhead which accounts to computation time and power. After positive threshold 80 the delay increases sharply.

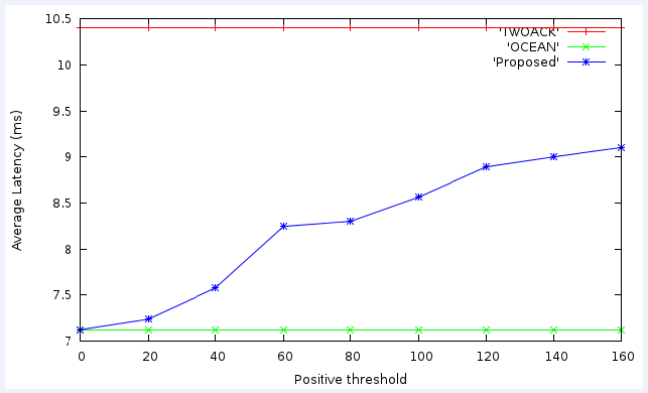

Figure 4 : Graph showing average latency at varying positive threshold

In Figure 5, we show the packet delivery ratio of our proposed scheme under the same conditions as mentioned above. It is observed that maximum packet delivery ratio is obtained at positive threshold 80 and after that packet delivery ratio varies and we do not observe much increase in it. It is due to increase in latency at high positive threshold and because of this less number of packets are able to reach the destination. So there is not much gain in increasing the positive threshold.

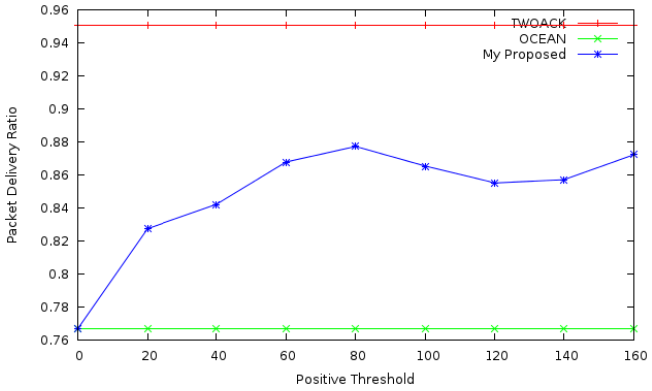

Figure 5 : Graph showing Packet Delivery Ratio at varying positive threshold

In Figure 6, we show the throughput of our proposed scheme at varying positive threshold. We observe that initially the throughput increases with increase in positive threshold but after a limit at positive threshold 80, we do not observe much increase in through put. It is due to the delay experienced by packets which results in less no of packets to reach the destination.

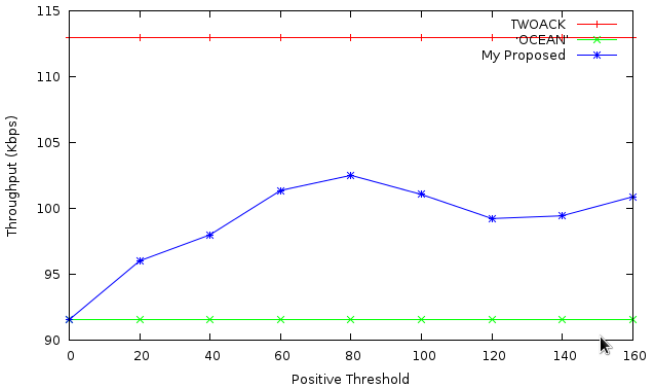

Figure 6 : Graph showing throughput at varying positive threshold

In Figure 7, we show the routing overhead of our proposed scheme at varying positive threshold.Routing overhead continiously increases with increase in positive threshold as the number of TWOACK packets increase. Since our proposed scheme does not broadcast RERR messages in case of

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detected misbehavior, overhead experienced by our proposed scheme will be less than TWOACK schme.

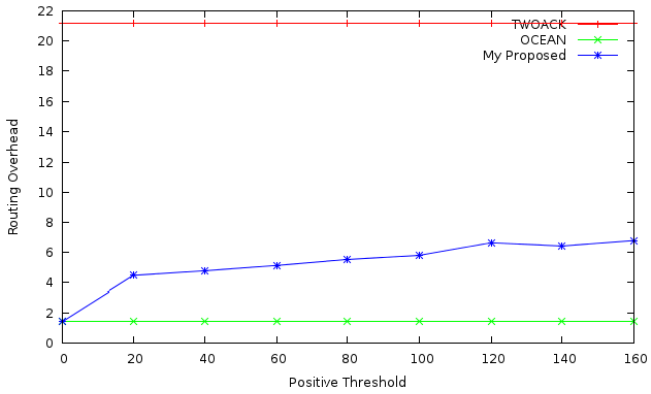

Figure 7 : Graph showing routing overhead at varying positive threshold

Now we evaluate the performance metrics at positive threshold 80 and varying percentage of misbehaving nodes. Figure 8 compares the packet delivery ratio of the TWOACK, OCEAN and our proposed scheme as a function of different percentage misbehaving nodes. The percentage of misbehaving nodes in the network was varied from 0 (all nodes are well-behaved) to 40%. From the figure, we can observe that the packet delivery ratio of our scheme is more than the OCEAN method. The packet delivery ratio decreases as the number of misbehaving node increase. This is due to the problem of missing routes and the overhead of searching for alternative routes. Compared with the OCEAN scheme, our proposed scheme maintains a relatively high packet delivery ratio. For example, when there are 40% nodes that are misbehaving, the proposed scheme delivers about 81-89% of data traffic.

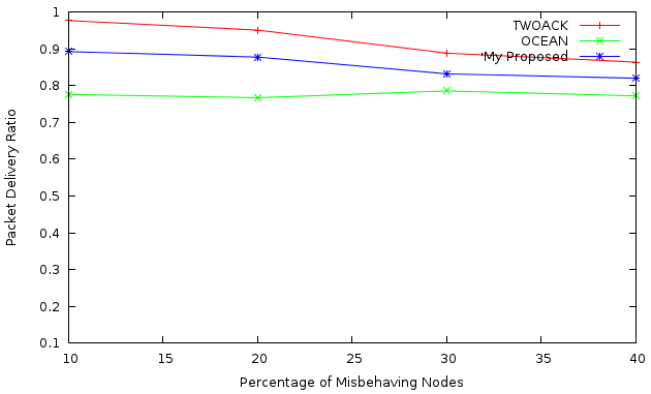

Figure 8 : Graph showing packet delvery ratio at Positive threshold 80 and varying percentage of misbehaving nodes

In Figure 9, we show the throughput of the TWOACK scheme, OCEAN scheme and our proposed scheme. The network parameters are the same as those used to obtain figure 8. It is evident from the curves that the throughput of our proposed scheme is better than OCEAN scheme.

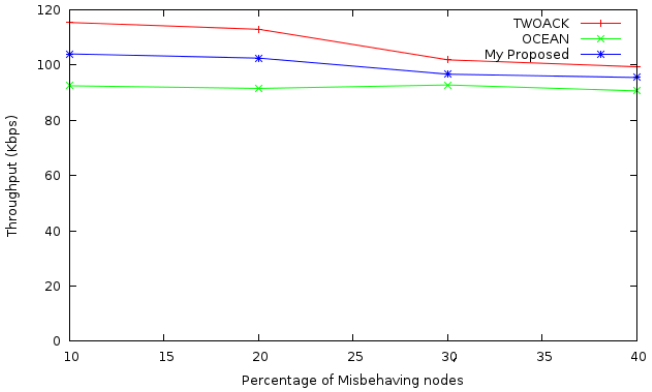

Figure 9 : Graph showing throughput at positive threshold 80 and varying percentage of misbehaving nodes

In Figure 10, we show the routing overhead of the TWOACK scheme and our proposed scheme. The network parameters are the same as those used to obtain figure 8. It is evident from the
curves that the routing overhead of our proposed scheme is much less than TWOACK scheme. Routing overhead of TWOACK scheme is mainly due to the transmissions of the TWOACK packet for each data packet processed by each of the triplets and the transmissions of RERR packets to report misbehaving nodes.

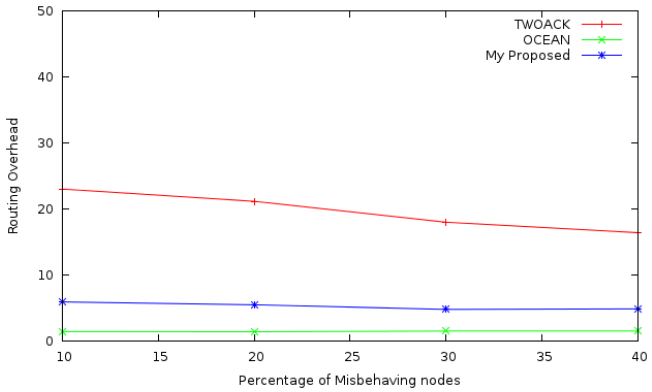

Figure 10 : Graph showing routing overhead at positive threshold 80 and varying percentage of misbehaving nodes

Figure 11 compares the Average Latency of the TWOACK, OCEAN and our new proposed scheme as a function of different percentage misbehaving nodes. From Figure 11, we can observe that the Average Latency of our scheme is less than the TWOACK scheme. It is due to less number of acknowledgement packets compared to TWOACK scheme.

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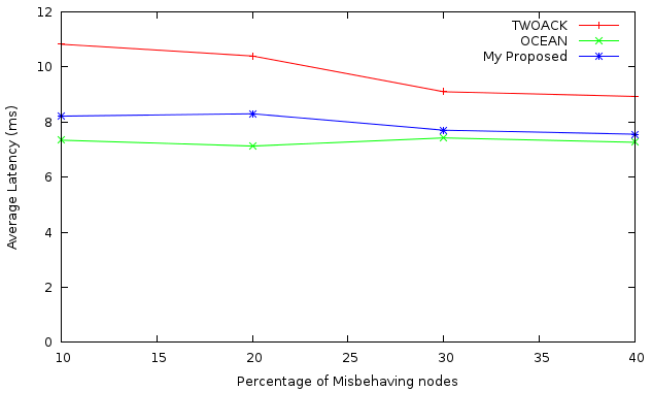

Figure 11 : Graph showing average latency at positive threshold 80 and varying percentage of misbehaving nodes

V. Conclusion

Mobile Ad Hoc Networks (MANETs) have been an active area of research over the past few years, due to their potentially widespread application in military and civilian communications. Such a network is highly dependent on the cooperation of all its members participating in the network. This makes it highly vulnerable to selfish nodes. In this paper, we have proposed and evaluated a scheme which is a combination of acknowledgement and overhearing based scheme, which can be easily added-on to source routing protocols such as the DSR protocol. The schemes detect misbehaving nodes so that other nodes may avoid them in future route selections, with the aim of overall improvement in performance metrics such as throughput, average latency, routing overhead and packet delivery ratio. Simulations have showed that, in a network where up to 40% of the nodes are misbehaving, the proposed scheme improves the throughput and packet delivery ratio compared to OCEAN method and reduced overhead and latency as compared to the TWOACK method. By introducing acknowledgements in OCEAN method the overhead is increased, but it is still less than original TWOACK scheme.

Therefore the proposed scheme can prove quite fruitful especially if less than half of network nodes are misbehaving. The scheme solves the overhearing problems unlike OCEAN and also keeps the routing overhead manageable under low to moderate traffic load unlike TWOACK.

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The ' MARSC ' title is accorded to a selected professional after the approval of the Editor-in-Chief / Editorial Board Members/Dean.
The “MARSC” is a dignified ornament which is accorded to a person’s name viz. Dr. John E. Hall, Ph.D., MARSC or William Walldroff, M.S., MARSC.

MARSC accrediting is an honor. It authenticates your research activities. After becoming MARSC, you can add 'MARSC' title with your name as you use this recognition as additional suffix to your status. This will definitely enhance and add more value and repute to your name. You may use it on your professional Counseling Materials such as CV, Resume, Visiting Card and Name Plate etc.

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The MARSC member can apply for approval, grading and certification of standards of their educational and Institutional Degrees to Open Association of Research, Society U.S.A.

Once you are designated as MARSC, you may send us a scanned copy of all of your credentials. OARS will verify, grade and certify them. This will be based on your academic records, quality of research papers published by you, and some more criteria.

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AUXILIARY MEMBERSHIPS

Institutional Fellow of Open Association of Research Society (USA)-OARS (USA)

Global Journals Incorporation (USA) is accredited by Open Association of Research Society, U.S.A (OARS) and in turn, affiliates research institutions as "Institutional Fellow of Open Association of Research Society" (IFOARS).

The "FARSC" is a dignified title which is accorded to a person's name viz. Dr. John E. Hall, Ph.D., FARSC or William Walldroff, M.S., FARSC.

The IFOARS institution is entitled to form a Board comprised of one Chairperson and three to five board members preferably from different streams. The Board will be recognized as "Institutional Board of Open Association of Research Society"-(IBOARS).

The Institute will be entitled to following benefits:

The IBOARS can initially review research papers of their institute and recommend them to publish with respective journal of Global Journals. It can also review the papers of other institutions after obtaining our consent. The second review will be done by peer reviewer of Global Journals Incorporation (USA) The Board is at liberty to appoint a peer reviewer with the approval of chairperson after consulting us.

The author fees of such paper may be waived off up to 40%.

The Global Journals Incorporation (USA) at its discretion can also refer double blind peer reviewed paper at their end to the board for the verification and to get recommendation for final stage of acceptance of publication.

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The Board can also play vital role by exploring and giving valuable suggestions regarding the Standards of "Open Association of Research Society, U.S.A (OARS)" so that proper amendment can take place for the benefit of entire research community. We shall provide details of particular standard only on receipt of request from the Board.

The board members can also join us as Individual Fellow with 40% discount on total fees applicable to Individual Fellow. They will be entitled to avail all the benefits as declared. Please visit Individual Fellow-sub menu of GlobalJournals.org to have more relevant details.

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After nomination of your institution as "Institutional Fellow" and constantly functioning successfully for one year, we can consider giving recognition to your institute to function as Regional/Zonal office on our behalf.
The board can also take up the additional allied activities for betterment after our consultation.

The following entitlements are applicable to individual Fellows:

Open Association of Research Society, U.S.A (OARS) By-laws states that an individual Fellow may use the designations as applicable, or the corresponding initials. The Credentials of individual Fellow and Associate designations signify that the individual has gained knowledge of the fundamental concepts. One is magnanimous and proficient in an expertise course covering the professional code of conduct, and follows recognized standards of practice.

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- The Fellow can organize symposium/seminar/conference on behalf of Global Journals Incorporation (USA) and he/she can also attend the same organized by other institutes on behalf of Global Journals.
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- The Fellow can earn 60% of sales proceeds from the sale of reference/review books/literature/publishing of research paper.
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- • This individual has learned the basic methods of applying those concepts and techniques to common challenging situations. This individual has further demonstrated an in–depth understanding of the application of suitable techniques to a particular area of research practice.

Note :

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- In future, if the board feels the necessity to change any board member, the same can be done with the consent of the chairperson along with anyone board member without our approval.
- In case, the chairperson needs to be replaced then consent of 2/3rd board members are required and they are also required to jointly pass the resolution copy of which should be sent to us. In such case, it will be compulsory to obtain our approval before replacement.
- In case of "Difference of Opinion [if any]" among the Board members, our decision will be final and binding to everyone.

"

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The paper should be in proper format. The format can be downloaded from first page of 'Author Guideline' Menu. The Author is expected to follow the general rules as mentioned in this menu. The paper should be written in MS-Word Format (*.DOC,*.DOCX).

The Author can submit the paper either online or offline. The authors should prefer online submission.Online Submission: There are three ways to submit your paper:

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You can use your own standard format also.
Author Guidelines:

1. General,

2. Ethical Guidelines,

3. Submission of Manuscripts,

4. Manuscript's Category,

5. Structure and Format of Manuscript,

6. After Acceptance.

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All authors should have been credited according to their appropriate contribution in research activity and preparing paper. Contributors who do not match the criteria as authors may be mentioned under Acknowledgement.

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Review papers: These are concise, significant but helpful and decisive topics for young researchers.

Research articles: These are handled with small investigation and applications.

Research letters: The letters are small and concise comments on previously published matters.

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The recommended size of original research paper is less than seven thousand words, review papers fewer than seven thousands words also.Preparation of research paper or how to write research paper, are major hurdle, while writing manuscript. The research articles and research letters should be fewer than three thousand words, the structure original research paper; sometime review paper should be as follows:

Papers: These are reports of significant research (typically less than 7000 words equivalent, including tables, figures, references), and comprise:

(a)Title should be relevant and commensurate with the theme of the paper.

(b) A brief Summary, "Abstract" (less than 150 words) containing the major results and conclusions.

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(e) Resources and techniques with sufficient complete experimental details (wherever possible by reference) to permit repetition; sources of information must be given and numerical methods must be specified by reference, unless non-standard.

(f) Results should be presented concisely, by well-designed tables and/or figures; the same data may not be used in both; suitable statistical data should be given. All data must be obtained with attention to numerical detail in the planning stage. As reproduced design has been recognized to be important to experiments for a considerable time, the Editor has decided that any paper that appears not to have adequate numerical treatments of the data will be returned un-refereed;

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(h) Brief Acknowledgements.

(i) References in the proper form.

Authors should very cautiously consider the preparation of papers to ensure that they communicate efficiently. Papers are much more likely to be accepted, if they are cautiously designed and laid out, contain few or no errors, are summarizing, and be conventional to the approach and instructions. They will in addition, be published with much less delays than those that require much technical and editorial correction.

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It is vital, that authors take care in submitting a manuscript that is written in simple language and adheres to published guidelines.

Format

Language: The language of publication is UK English. Authors, for whom English is a second language, must have their manuscript efficiently edited by an English-speaking person before submission to make sure that, the English is of high excellence. It is preferable, that manuscripts should be professionally edited.

Standard Usage, Abbreviations, and Units: Spelling and hyphenation should be conventional to The Concise Oxford English Dictionary. Statistics and measurements should at all times be given in figures, e.g. 16 min, except for when the number begins a sentence. When the number does not refer to a unit of measurement it should be spelt in full unless, it is 160 or greater.

Abbreviations supposed to be used carefully. The abbreviated name or expression is supposed to be cited in full at first usage, followed by the conventional abbreviation in parentheses.

Metric SI units are supposed to generally be used excluding where they conflict with current practice or are confusing. For illustration, 1.4 l rather than 1.4 × 10-3 m3, or 4 mm somewhat than 4 × 10-3 m. Chemical formula and solutions must identify the form used, e.g. anhydrous or hydrated, and the concentration must be in clearly defined units. Common species names should be followed by underlines at the first mention. For following use the generic name should be constricted to a single letter, if it is clear.

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One must be persistent and creative in using keywords. An effective keyword search requires a strategy and planning a list of possible keywords and phrases to try.

Search engines for most searches, use Boolean searching, which is somewhat different from Internet searches. The Boolean search uses "operators," words (and, or, not, and near) that enable you to expand or narrow your affords. Tips for research paper while preparing research paper are very helpful guideline of research paper.

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- One should start brainstorming lists of possible keywords before even begin searching. Think about the most important concepts related to research work. Ask, "What words would a source have to include to be truly valuable in research paper?" Then consider synonyms for the important words.
- It may take the discovery of only one relevant paper to let steer in the right keyword direction because in most databases, the keywords under which a research paper is abstracted are listed with the paper.
- One should avoid outdated words.

Keywords are the key that opens a door to research work sources. Keyword searching is an art in which researcher's skills are bound to improve with experience and time.

Numerical Methods: Numerical methods used should be clear and, where appropriate, supported by references.

Acknowledgements: Please make these as concise as possible.

References

References follow the Harvard scheme of referencing. References in the text should cite the authors' names followed by the time of their publication, unless there are three or more authors when simply the first author's name is quoted followed by et al. unpublished work has to only be cited where necessary, and only in the text. Copies of references in press in other journals have to be supplied with submitted typescripts. It is necessary that all citations and references be carefully checked before submission, as mistakes or omissions will cause delays.

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Please note that if not specifically requested, publisher will dispose off hardcopy & electronic information submitted, after the two months of publication. If you require the return of any information submitted, please inform the Editorial Board or dean as soon as possible.

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Before start writing a good quality Computer Science Research Paper, let us first understand what is Computer Science Research Paper? So, Computer Science Research Paper is the paper which is written by professionals or scientists who are associated to Computer Science and Information Technology, or doing research study in these areas. If you are novel to this field then you can consult about this field from your supervisor or guide.

TECHNIQUES FOR WRITING A GOOD QUALITY RESEARCH PAPER:

1. Choosing the topic: In most cases, the topic is searched by the interest of author but it can be also suggested by the guides. You can have several topics and then you can judge that in which topic or subject you are finding yourself most comfortable. This can be done by asking several questions to yourself, like Will I be able to carry our search in this area? Will I find all necessary recourses to accomplish the search? Will I be able to find all information in this field area? If the answer of these types of questions will be "Yes" then you can choose that topic. In most of the cases, you may have to conduct the surveys and have to visit several places because this field is related to Computer Science and Information Technology. Also, you may have to do a lot of work to find all rise and falls regarding the various data of that subject. Sometimes, detailed information plays a vital role, instead of short information.

2. Evaluators are human: First thing to remember that evaluators are also human being. They are not only meant for rejecting a paper. They are here to evaluate your paper. So, present your Best.

3. Think Like Evaluators: If you are in a confusion or getting demotivated that your paper will be accepted by evaluators or not, then think and try to evaluate your paper like an Evaluator. Try to understand that what an evaluator wants in your research paper and automatically you will have your answer.

4. Make blueprints of paper: The outline is the plan or framework that will help you to arrange your thoughts. It will make your paper logical. But remember that all points of your outline must be related to the topic you have chosen.

5. Ask your Guides: If you are having any difficulty in your research, then do not hesitate to share your difficulty to your guide (if you have any). They will surely help you out and resolve your doubts. If you can't clarify what exactly you require for your work then ask the supervisor to help you with the alternative. He might also provide you the list of essential readings.

6. Use of computer is recommended: As you are doing research in the field of Computer Science, then this point is quite obvious.

7. Use right software: Always use good quality software packages. If you are not capable to judge good software then you can lose quality of your paper unknowingly. There are various software programs available to help you, which you can get through Internet.

8. Use the Internet for help: An excellent start for your paper can be by using the Google. It is an excellent search engine, where you can have your doubts resolved. You may also read some answers for the frequent question how to write my research paper or find model research paper. From the internet library you can download books. If you have all required books make important reading selecting and analyzing the specified information. Then put together research paper sketch out.

9. Use and get big pictures: Always use encyclopedias, Wikipedia to get pictures so that you can go into the depth.

10. Bookmarks are useful: When you read any book or magazine, you generally use bookmarks, right! It is a good habit, which helps to not to lose your continuity. You should always use bookmarks while searching on Internet also, which will make your search easier.

11. Revise what you wrote: When you write anything, always read it, summarize it and then finalize it.

12. Make all efforts: Make all efforts to mention what you are going to write in your paper. That means always have a good start. Try to mention everything in introduction, that what is the need of a particular research paper. Polish your work by good skill of writing and always give an evaluator, what he wants.

13. Have backups: When you are going to do any important thing like making research paper, you should always have backup copies of it either in your computer or in paper. This will help you to not to lose any of your important.

14. Produce good diagrams of your own: Always try to include good charts or diagrams in your paper to improve quality. Using several and unnecessary diagrams will degrade the quality of your paper by creating "hotchpotch." So always, try to make and include those diagrams, which are made by your own to improve readability and understandability of your paper.

15. Use of direct quotes: When you do research relevant to literature, history or current affairs then use of quotes become essential but if study is relevant to science then use of quotes is not preferable.

16. Use proper verb tense: Use proper verb tenses in your paper. Use past tense, to present those events that happened. Use present tense to indicate events that are going on. Use future tense to indicate future happening events. Use of improper and wrong tenses will confuse the evaluator. Avoid the sentences that are incomplete.

17. Never use online paper: If you are getting any paper on Internet, then never use it as your research paper because it might be possible that evaluator has already seen it or maybe it is outdated version.

18. Pick a good study spot: To do your research studies always try to pick a spot, which is quiet. Every spot is not for studies. Spot that suits you choose it and proceed further.

19. Know what you know: Always try to know, what you know by making objectives. Else, you will be confused and cannot achieve your target.

20. Use good quality grammar: Always use a good quality grammar and use words that will throw positive impact on evaluator. Use of good quality grammar does not mean to use tough words, that for each word the evaluator has to go through dictionary. Do not start sentence with a conjunction. Do not fragment sentences. Eliminate one-word sentences. Ignore passive voice. Do not ever use a big word when a diminutive one would suffice. Verbs have to be in agreement with their subjects. Prepositions are not expressions to finish sentences with. It is incorrect to ever divide an infinitive. Avoid clichés like the disease. Also, always shun irritating alliteration. Use language that is simple and straight forward. put together a neat summary.

21. Arrangement of information: Each section of the main body should start with an opening sentence and there should be a changeover at the end of the section. Give only valid and powerful arguments to your topic. You may also maintain your arguments with records.

22. Never start in last minute: Always start at right time and give enough time to research work. Leaving everything to the last minute will degrade your paper and spoil your work.

23. Multitasking in research is not good: Doing several things at the same time proves bad habit in case of research activity. Research is an area, where everything has a particular time slot. Divide your research work in parts and do particular part in particular time slot.

24. Never copy others' work: Never copy others' work and give it your name because if evaluator has seen it anywhere you will be in trouble.

25. Take proper rest and food: No matter how many hours you spend for your research activity, if you are not taking care of your health then all your efforts will be in vain. For a quality research, study is must, and this can be done by taking proper rest and food.

26. Go for seminars: Attend seminars if the topic is relevant to your research area. Utilize all your resources.

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27. Refresh your mind after intervals: Try to give rest to your mind by listening to soft music or by sleeping in intervals. This will also improve your memory.

28. Make colleagues: Always try to make colleagues. No matter how sharper or intelligent you are, if you make colleagues you can have several ideas, which will be helpful for your research.

29. Think technically: Always think technically. If anything happens, then search its reasons, its benefits, and demerits.

30. Think and then print: When you will go to print your paper, notice that tables are not be split, headings are not detached from their descriptions, and page sequence is maintained.

31. Adding unnecessary information: Do not add unnecessary information, like, I have used MS Excel to draw graph. Do not add irrelevant and inappropriate material. These all will create superfluous. Foreign terminology and phrases are not apropos. One should NEVER take a broad view. Analogy in script is like feathers on a snake. Not at all use a large word when a very small one would be sufficient. Use words properly, regardless of how others use them. Remove quotations. Puns are for kids, not grunt readers. Amplification is a billion times of inferior quality than sarcasm.

32. Never oversimplify everything: To add material in your research paper, never go for oversimplification. This will definitely irritate the evaluator. Be more or less specific. Also too, by no means, ever use rhythmic redundancies. Contractions aren't essential and shouldn't be there used. Comparisons are as terrible as clichés. Give up ampersands and abbreviations, and so on. Remove commas, that are, not necessary. Parenthetical words however should be together with this in commas. Understatement is all the time the complete best way to put onward earth-shaking thoughts. Give a detailed literary review.

33. Report concluded results: Use concluded results. From raw data, filter the results and then conclude your studies based on measurements and observations taken. Significant figures and appropriate number of decimal places should be used. Parenthetical remarks are prohibitive. Proofread carefully at final stage. In the end give outline to your arguments. Spot out perspectives of further study of this subject. Justify your conclusion by at the bottom of them with sufficient justifications and examples.

34. After conclusion: Once you have concluded your research, the next most important step is to present your findings. Presentation is extremely important as it is the definite medium though which your research is going to be in print to the rest of the crowd. Care should be taken to categorize your thoughts well and present them in a logical and neat manner. A good quality research paper format is essential because it serves to highlight your research paper and bring to light all necessary aspects in your research.

Informal Guidelines of Research Paper Writing

Key points to remember:

- Submit all work in its final form.
- Write your paper in the form, which is presented in the guidelines using the template.
- Please note the criterion for grading the final paper by peer-reviewers.

Final Points:

A purpose of organizing a research paper is to let people to interpret your effort selectively. The journal requires the following sections, submitted in the order listed, each section to start on a new page.

The introduction will be compiled from reference matter and will reflect the design processes or outline of basis that direct you to make study. As you will carry out the process of study, the method and process section will be constructed as like that. The result segment will show related statistics in nearly sequential order and will direct the reviewers next to the similar intellectual paths throughout the data that you took to carry out your study. The discussion section will provide understanding of the data and projections as to the implication of the results. The use of good quality references all through the paper will give the effort trustworthiness by representing an alertness of prior workings.

Writing a research paper is not an easy job no matter how trouble-free the actual research or concept. Practice, excellent preparation, and controlled record keeping are the only means to make straightforward the progression.

General style:

Specific editorial column necessities for compliance of a manuscript will always take over from directions in these general guidelines.

To make a paper clear

· Adhere to recommended page limits

Mistakes to evade

- Insertion a title at the foot of a page with the subsequent text on the next page
- Separating a table/chart or figure - impound each figure/table to a single page
- Submitting a manuscript with pages out of sequence

In every sections of your document

· Use standard writing style including articles ("a", "the," etc.)

· Keep on paying attention on the research topic of the paper

· Use paragraphs to split each significant point (excluding for the abstract)

· Align the primary line of each section

· Present your points in sound order

· Use present tense to report well accepted

· Use past tense to describe specific results

· Shun familiar wording, don't address the reviewer directly, and don't use slang, slang language, or superlatives

· Shun use of extra pictures - include only those figures essential to presenting results

Title Page:

Choose a revealing title. It should be short. It should not have non-standard acronyms or abbreviations. It should not exceed two printed lines. It should include the name(s) and address (es) of all authors.

Abstract:

The summary should be two hundred words or less. It should briefly and clearly explain the key findings reported in the manuscript--must have precise statistics. It should not have abnormal acronyms or abbreviations. It should be logical in itself. Shun citing references at this point.

An abstract is a brief distinct paragraph summary of finished work or work in development. In a minute or less a reviewer can be taught the foundation behind the study, common approach to the problem, relevant results, and significant conclusions or new questions.

Write your summary when your paper is completed because how can you write the summary of anything which is not yet written? Wealth of terminology is very essential in abstract. Yet, use comprehensive sentences and do not let go readability for briefness. You can maintain it succinct by phrasing sentences so that they provide more than lone rationale. The author can at this moment go straight to shortening the outcome. Sum up the study, with the subsequent elements in any summary. Try to maintain the initial two items to no more than one ruling each.

- Reason of the study - theory, overall issue, purpose
- Fundamental goal
- To the point depiction of the research
- Consequences, including definite statistics - if the consequences are quantitative in nature, account quantitative data; results of any numerical analysis should be reported
- Significant conclusions or questions that track from the research(es)

Approach:

- Single section, and succinct
- As a outline of job done, it is always written in past tense
- A conceptual should situate on its own, and not submit to any other part of the paper such as a form or table
- Center on shortening results - bound background information to a verdict or two, if completely necessary
- What you account in an conceptual must be regular with what you reported in the manuscript
- Exact spelling, clearness of sentences and phrases, and appropriate reporting of quantities (proper units, important statistics) are just as significant in an abstract as they are anywhere else

Introduction:

The **Introduction** should "introduce" the manuscript. The reviewer should be presented with sufficient background information to be capable to comprehend and calculate the purpose of your study without having to submit to other works. The basis for the study should be offered. Give most important references but shun difficult to make a comprehensive appraisal of the topic. In the introduction, describe the problem visibly. If the problem is not acknowledged in a logical, reasonable way, the reviewer will have no attention in your result. Speak in common terms about techniques used to explain the problem, if needed, but do not present any particulars about the protocols here. Following approach can create a valuable beginning:

- Explain the value (significance) of the study
- Shield the model - why did you employ this particular system or method? What is its compensation? You strength remark on its appropriateness from a abstract point of vision as well as point out sensible reasons for using it.
- Present a justification. Status your particular theory (es) or aim(s), and describe the logic that led you to choose them.
- Very for a short time explain the tentative propose and how it skilled the declared objectives.

Approach:

- Use past tense except for when referring to recognized facts. After all, the manuscript will be submitted after the entire job is done.
- Sort out your thoughts; manufacture one key point with every section. If you make the four points listed above, you will need a least of four paragraphs.

- Present surroundings information only as desirable in order hold up a situation. The reviewer does not desire to read the whole thing you know about a topic.
- Shape the theory/purpose specifically - do not take a broad view.
- As always, give awareness to spelling, simplicity and correctness of sentences and phrases.

Procedures (Methods and Materials):

This part is supposed to be the easiest to carve if you have good skills. A sound written Procedures segment allows a capable scientist to replacement your results. Present precise information about your supplies. The suppliers and clarity of reagents can be helpful bits of information. Present methods in sequential order but linked methodologies can be grouped as a segment. Be concise when relating the protocols. Attempt for the least amount of information that would permit another capable scientist to spare your outcome but be cautious that vital information is integrated. The use of subheadings is suggested and ought to be synchronized with the results section. When a technique is used that has been well described in another object, mention the specific item describing a way but draw the basic principle while stating the situation. The purpose is to text all particular resources and broad procedures, so that another person may use some or all of the methods in one more study or referee the scientific value of your work. It is not to be a step by step report of the whole thing you did, nor is a methods section a set of orders.

Materials:

- Explain materials individually only if the study is so complex that it saves liberty this way.
- Embrace particular materials, and any tools or provisions that are not frequently found in laboratories.
- Do not take in frequently found.
- If use of a definite type of tools.
- Materials may be reported in a part section or else they may be recognized along with your measures.

Methods:

- Report the method (not particulars of each process that engaged the same methodology)
- Describe the method entirely
- To be succinct, present methods under headings dedicated to specific dealings or groups of measures
- Simplify - details how procedures were completed not how they were exclusively performed on a particular day.
- If well known procedures were used, account the procedure by name, possibly with reference, and that's all.

Approach:

- It is embarrassed or not possible to use vigorous voice when documenting methods with no using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result when script up the methods most authors use third person passive voice.
- Use standard style in this and in every other part of the paper - avoid familiar lists, and use full sentences.

What to keep away from

- Resources and methods are not a set of information.
- Skip all descriptive information and surroundings - save it for the argument.
- Leave out information that is immaterial to a third party.

Results:

The principle of a results segment is to present and demonstrate your conclusion. Create this part a entirely objective details of the outcome, and save all understanding for the discussion.

The page length of this segment is set by the sum and types of data to be reported. Carry on to be to the point, by means of statistics and tables, if suitable, to present consequences most efficiently.You must obviously differentiate material that would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matter should not be submitted at all except requested by the instructor.

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Content

- Sum up your conclusion in text and demonstrate them, if suitable, with figures and tables.
- In manuscript, explain each of your consequences, point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation an exacting study.
- Explain results of control experiments and comprise remarks that are not accessible in a prescribed figure or table, if appropriate.
- Examine your data, then prepare the analyzed (transformed) data in the form of a figure (graph), table, or in manuscript form.

What to stay away from

- Do not discuss or infer your outcome, report surroundings information, or try to explain anything.
- Not at all, take in raw data or intermediate calculations in a research manuscript.
- Do not present the similar data more than once.
- Manuscript should complement any figures or tables, not duplicate the identical information.
- Never confuse figures with tables - there is a difference.

Approach

- As forever, use past tense when you submit to your results, and put the whole thing in a reasonable order.
- Put figures and tables, appropriately numbered, in order at the end of the report
- If you desire, you may place your figures and tables properly within the text of your results part.

Figures and tables

- If you put figures and tables at the end of the details, make certain that they are visibly distinguished from any attach appendix materials, such as raw facts
- Despite of position, each figure must be numbered one after the other and complete with subtitle
- In spite of position, each table must be titled, numbered one after the other and complete with heading
- All figure and table must be adequately complete that it could situate on its own, divide from text

Discussion:

The Discussion is expected the trickiest segment to write and describe. A lot of papers submitted for journal are discarded based on problems with the Discussion. There is no head of state for how long a argument should be. Position your understanding of the outcome visibly to lead the reviewer through your conclusions, and then finish the paper with a summing up of the implication of the study. The purpose here is to offer an understanding of your results and hold up for all of your conclusions, using facts from your research and generally accepted information, if suitable. The implication of result should be visibly described. Infer your data in the conversation in suitable depth. This means that when you clarify an observable fact you must explain mechanisms that may account for the observation. If your results vary from your prospect, make clear why that may have happened. If your results agree, then explain the theory that the proof supported. It is never suitable to just state that the data approved with prospect, and let it drop at that.

- Make a decision if each premise is supported, discarded, or if you cannot make a conclusion with assurance. Do not just dismiss a study or part of a study as "uncertain."
- Research papers are not acknowledged if the work is imperfect. Draw what conclusions you can based upon the results that you have, and take care of the study as a finished work
- You may propose future guidelines, such as how the experiment might be personalized to accomplish a new idea.
- Give details all of your remarks as much as possible, focus on mechanisms.
- Make a decision if the tentative design sufficiently addressed the theory, and whether or not it was correctly restricted.
- Try to present substitute explanations if sensible alternatives be present.
- One research will not counter an overall question, so maintain the large picture in mind, where do you go next? The best studies unlock new avenues of study. What questions remain?
- Recommendations for detailed papers will offer supplementary suggestions.

Approach:

- When you refer to information, differentiate data generated by your own studies from available information
- Submit to work done by specific persons (including you) in past tense.
- Submit to generally acknowledged facts and main beliefs in present tense.

Please carefully note down following rules and regulation before submitting your Research Paper to Global Journals Inc. (US):

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- The **major constraint** is that you must independently make all content, tables, graphs, and facts that are offered in the paper. You must write each part of the paper wholly on your own. The Peer-reviewers need to identify your own perceptive of the concepts in your own terms. NEVER extract straight from any foundation, and never rephrase someone else's analysis.

- Do not give permission to anyone else to "PROOFREAD" your manuscript.

- Methods to avoid Plagiarism is applied by us on every paper, if found guilty, you will be blacklisted by all of our collaborated research groups, your institution will be informed for this and strict legal actions will be taken immediately.)
- To guard yourself and others from possible illegal use please do not permit anyone right to use to your paper and files.

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Topics	Grades		
	A-B	**C-D**	**E-F**
Abstract	Clear and concise with appropriate content, Correct format. 200 words or below	Unclear summary and no specific data, Incorrect form Above 200 words	No specific data with ambiguous information Above 250 words
Introduction	Containing all background details with clear goal and appropriate details, flow specification, no grammar and spelling mistake, well organized sentence and paragraph, reference cited	Unclear and confusing data, appropriate format, grammar and spelling errors with unorganized matter	Out of place depth and content, hazy format
Methods and Procedures	Clear and to the point with well arranged paragraph, precision and accuracy of facts and figures, well organized subheads	Difficult to comprehend with embarrassed text, too much explanation but completed	Incorrect and unorganized structure with hazy meaning
Result	Well organized, Clear and specific, Correct units with precision, correct data, well structuring of paragraph, no grammar and spelling mistake	Complete and embarrassed text, difficult to comprehend	Irregular format with wrong facts and figures
Discussion	Well organized, meaningful specification, sound conclusion, logical and concise explanation, highly structured paragraph reference cited	Wordy, unclear conclusion, spurious	Conclusion is not cited, unorganized, difficult to comprehend
References	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring

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