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## Research Article

# QR CODE IMAGE STEGANOGRAPHY (LSB BIT) WITH SECRET IMAGE (MSB BIT) USING AES CRYPTOGRAPHY AND JPEG COMPRESSION

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### ABSTRACT

System of embedding mystery statistics in pictures, which could not be identified by the source and the destination, is known as Image Steganography. It is very useful to hide secret text message in an image. This paper talks about the image steganography and the use of Block Based Discrete Wavelet Transforms (DWT) for embedding the encoded mystery message by QR code into the photograph with the help of Advanced Encryption Standard (AES) cipher algorithm. It can converse approximately exact observation of Quick Response (QR) codes, their organization and use of QR codes in the area of data protection. Our study also observes the (Peak Signal-to-Noise Ratio) on LSB bit primarily based records hiding approach. This approach offers satisfactory photo greatest procedures among the Cover QR and the Stego QR, as the covert information which has been embedded to its first-rate matching pixel fee of the duvet QR code.

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## INTRODUCTION

Steganography is a process by which we can hide the existence of the conversation, in the different medium like picture, audio, video, text, and so forth. It hides text message in a mystery message, which cannot be recognized to anyone apart from source and destination. QR Codes are used to deliver or keep messages because they have big storage ability than any other normal barcodes. Since QR Codes react quickly and have large storage capacity, QR Codes are used to send encrypted facts (messages) to the receiver. The block based totally DWT set of rules are used for the steganography and additional protection is carried out by means of the usage of utilising AES cryptography to the QR code in advance than embedding it into the quilt picture [1].

### QR Code (Quick Response Code)

QR Codes are unique sort of 2-dimensional barcode designed with the aid of Japanese vehicle enterprise. The idea was first proposed by means of Denso Wave, QR Codes are normally connected to the items and includes records approximately that item, information can be in form of numeric facts, alphanumeric and binary, it makes the QR Code capable of storing theoretically any kind of records so long since they're

represented in binary. QR Code machine has fast clarity and remarkable storage capacity which made it famous out of doors the car enterprise, it is fabricated from black dots arranged in a matrix-like order with a white history, and this layout makes it easier for imaging gadgets to seize, correct and interpret data saved in QR Codes [2].

### Steganography

Steganography is an embedding approach to cover the statistics within the form of a photograph or text. It refers to hide facts or a document that has been hidden within a digital image (DI), Video or Audio record. In steganography, the figures or information are not always made in the original layout. It has been converted or replaced in a similar transmission record, like picture/image, video or audio, which is an unseen creature among other things. This apparent message (called cover textual content in standard phrases) is dispatched through the network to the receiver; anywhere the precise message is alienated from it [3].

Cryptography is a method by which privacy of common can be ensured. It provides the guarantee of privacy of communication between parties. With the help of a valid key, the ciphertext may be decrypted to the original plaintext. Plaintext cannot be

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retrieves without knowing the important thing. Cryptography performs an important role in many offerings, like: confidentiality, key exchange, authentication and non-repudiation. Cryptography provides these services for relaxed verbal exchange throughout insecure channels; Figure 1 indicates the cryptography system.

There are 3 kinds of cryptographic schemes for securing the data: public-key cryptography, secret key cryptography, and hash features. These schemes are used to acquire exceptional goals. The duration and type of the keys used depend on the type of encryption algorithm [4].

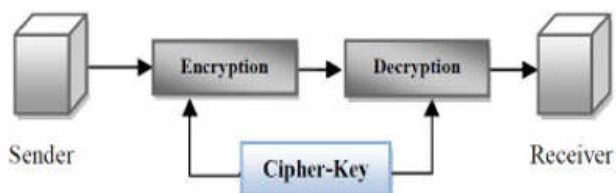


Figure 1 Cryptography System

QR codes, are 2-D codes that have a look at facts and media available via the code. QR Code services are available in various types of e-gadgets.

Decoding software program on digital telephones interprets the codes that may be determined on product labels, billboards, and houses inviting passersby to pull out their cellular phones and find the encoded data. The low technical barrier of making and studying QR codes allows present day educators to encompass them into their instructional endeavors. The operations to retrieve or shop QR codes are extraordinarily clean and quick, and with mobile devices, reason them to the suitable instructional equipment for teaching and learning.

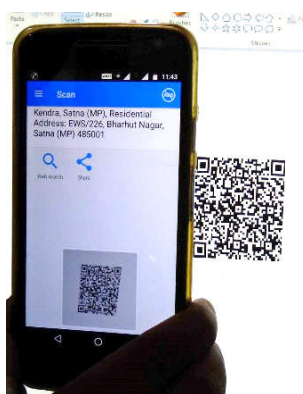


Figure 2 Scanning QR code with the mobile apps.

QR codes are similar to the barcodes utilized by shops to music inventory and price products at point of sale. Bar codes can fine keep up to twenty numerical digits; at the same time as QR codes are 2D and might preserve hundreds of alphanumeric characters of records [5].

### Related work

V.Hajduk,(2016) In this there is picture steganographic approach that's capable of embed the encoded mystery message with the use of QRcode into the photograph information. The relation among protection and functionality of the approach became improved through particular density of QR code earlier

than the embedding approach[6].Vladimir Hajduk, (2016) this paper is targeted on suggestion of picture steganographic technique. This is capable of embedding of encoded covert msg using QR code into photo facts. DWT area is used for the embedding of QR code; whilst implant method is moreover covered by AES cipher set of rules[7].Pei-Yu Lina, (2016) The non-public data can be embedded into a cowl QR tag with excessive mystery payload. For an everyday scanner, a browser can screen the cover QR content material from the marked QR code. The mechanism is efficient and possible for non-public QR programs [8].S. S. Patil, (2016) the authors provide a new method known as multi-stage mystery statistics hiding which integrates two exceptional techniques of encryption, particularly: able to be seen cryptography and steganography[9]. B. Karthikeyan, (2016) They presents a way based totally on combining both sturdy encryption set of rules and steganographic method to make the communication of exclusive records secure, relaxed and extraordinarily hard to decode. At the receiver's aspect, the secret statistics is retrieved via the decoding technique. Thus, a four-degree security has been rendered for a mystery message to be transferred [10].B. Pillai, (2016) They used a 16 spherical DES with sixty four-bit block length. After that the KMeans Clustering of the pixels which clusters the image into numerous segments and embedded data in every segment. These segments are to be hidden in each cluster. They used the LSB method for this purpose [11]. A. Gaikwad, (2015) They say that embedding techniques are designed to be well matched with preferred interpreting programs and might be carried out to some shade or grey scale photograph by complete area insurance [12]. M. Broda, et.al (2015), In this paper, an absolutely distinctive technique is used, in which the marks received by means of a candidate will be encoded in QR Code in encrypted type, so that if an interloper tries to trade the marks inside the mark sheet then he cannot do that, due to the encryption secret is unknown to him [13]. EuisungKang, (2014) In this paper, a modification approach for QR code using kernel based Hough rework (HF) is proposed. The kernel primarily based definitely HF indicates extensively better overall presentation than the same old HF in phrases of computational value, at the same time as retaining robust effect[14].

RSA algorithm is used by modern computers to encrypt and decrypt message. It is an asymmetric cryptographic algorithm. In comparison of base and propose, two algorithms are used for different propose RSA is really helpful for key exchange but it is slow to use. AES is really fast but suffers from the security risk if key exchange.

The main objective of our work is to generate QR code for the text message and hide into the cover image using AES and JPEG compression steganography with LSB bit and MSB bit. Also the objective of work is to increase the PSNR value than base code.

### Steganography Technique

#### QR Code

QR code are more effective than a standard bar code, they can keep a lot more statistics, including URL hyperlinks, geo coordinates, and textual content. The other capabilities of QR code is in place of requiring a corpulent handheld scanner to

experiment them, many cutting-edge mobile smart phone scan them.

**Discrete wavelet transforms (DWT)**

DWT also a frequency domain and image transform method that is used to divide the information of any digital media into sub signal (used to reveal the pixel value) and full sub signal (used to show the vertical, horizontal and diagonal info). In this manner data disguise in the shape of coefficients, for each of these techniques (DWT and DCT), the encoding machine and interpreting device of compression are required to transfer the unique picture into compressed photograph. In encoding system original photograph take as input and compressed image take as output at the same time as in interpreting machine compressed picture take as output and unique photograph take as input [15].

**LSB**

It is one of the most important procedures in spatial domain steganography picture. LSB is the bottom giant bit within the byte price of an image pixel. The LSB based photo steganography embeds the name of the game in LSB of pixels values of the quilt picture. It abuses the truth that the level of exactness in numerous photograph code's is a long way extra than that perceivable with the aid of common human imaginative and prescient. Therefore, an altered image with mild versions in shades can be indistinguishable from the authentic by means of human being, simply with the aid of looking at it [16].

**Most significant bit (MSB)**

In computing, the MSB is the bit which has the most significant value in a multi-bit binary gigantic range. The MSB is the single that is furthest to the left. As binary numbers are in large part utilized in computing and other associated areas, the MSB holds importance, in particular on the subject of transmission of a binary quantity.

Digital records are computed in a binary layout and just like numerical notation; the leftmost digit is taken into consideration the best digit, whereas the rightmost is taken into consideration as lowest digit. Due to the positional notation, the maximum significant bit is also called the leftmost bit. In a multi-bit binary number, the significance of a piece will increase because it procedures the MSB. Since it is binary, the MSB can be either 1 or 0.

**AES**

The choice method for this new symmetric key set of rules become completely open to public scrutiny and remark; this ensured a radical, obvious evaluation of the plans presented.

NIST unique the brand new advanced encryption general set of rules should be a block cipher able to coping with 128 bit blocks, the usage of keys sized at 128, 192, and 256 bits; different standards for being selected as the subsequent advanced encryption widespread algorithm included.

**JPEG Compression**

The technique of embedding records in the course of JPEG density effects in a stego photograph with an excessive degree of invisibility, because the implanted obtain region in the TD.

initially it became consideration so as to steganography could no longer be viable to utilize by JPEG snap shots, when you consider that they utilize lossy pressure which winds up in components of the picture information being adjusted. JPEG photos are the products of virtual cameras, scanners, and other photographic picture seizes gadgets. This is completely why hiding mystery certainties in JPEG pictures may offer a higher hide [17].

**Proposed Methodology**

The proposed method cover mystery textual content in QR code, earlier than hiding the QR code in the cover picture. The QR is saved as a black and white picture with 1 bit in keeping with pixel and is saved in an array of bytes to be encrypted the usage of AES earlier than embedding it within the cover picture. AES compresses three block ciphers: AES-128, AES-192 and AES-256. Each cipher encrypts and decrypts data in block of 28 bits using cryptographic key of 128.192, 256-bits, respective. AES is a most suitable algorithm for encryption when it compares with other encryption algorithms the proposed scheme is implemented in MATLAB platform using standard LSB using cover image and MSB using secret image steganography algorithm and using JPEG compression.

DWT space is utilized for the implanting of QR code, at the same time as embedding method is moreover included by way of using AES cipher set of rules. In addition, traditional traits of QR code become broken the use of the encryption, consequently it makes the approach extra comfortable. The intention of this paper is to develop steganographic picture technique with elevated comfortable stage and high non-detectable quality level.

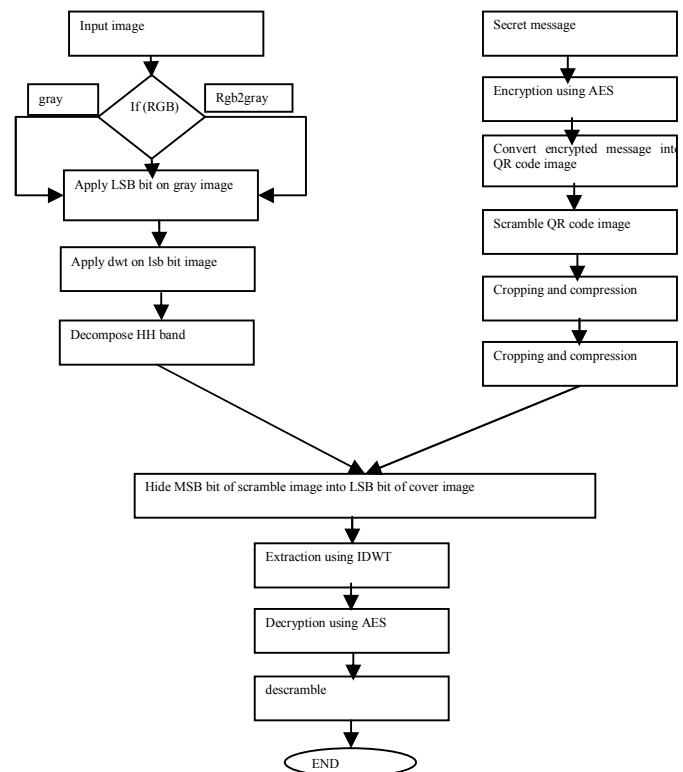


Figure 3 Flow chart of propose work

The connection amongst security and limit of the strategy move toward becoming advanced with the progressed aid of unique pressure of QR code before the inserting procedure.

Productivity of the proposed process became deliberate through the use of PSNR and carried out outcomes have been in comparison with different steganographic implement.

**Proposed Algorithm**

- Step 1: First browse an image and check RGB or Gray.
- If (RGB)
- RGB2Gray
- End.
- Step.2: Apply LSB substitution on Gray image and decompose the LSB bit image.
- Step 3: Now generate the QR code image using AES encryption Algorithm.
- Step 4: Now scramble the QR coded image and substitute MSB bit in scrambled image.
- Step 5: Comparison the MSB bit image.
- Step 6: Embed the MSB bit image into Cover image.
- Step 7: Extract the MSB bit image from embedded image.
- Step 8: Now descramble the extracted image and we obtain the QR-code image.
- Step 9: Decrypt the encrypted text.
- Step 10: Calculate PSNR.

**RESULT AND ANALYSIS**

The proposed scheme is implemented in MATLAB platform using standard LSB using cover image and MSB using secret message steganography algorithm and using JPEG compression. MATLAB is an excessive largely presentation language for specialized PC, incorporates calculation, representation and programming in a smooth to utilize environment. One of the pursuits for choosing to estimate the overall performance of the proposed procedure. We enforce the proposed approach with the aid of the usage of MATLAB R2013b. MATLAB to suit flawlessly in the requirements of a photograph processing studies because of its inherent traits and helpful to remedy issues with matrix and vector formulations.

The most important criteria which must be met by any data embedding algorithm is imperceptibility. [9] It is evaluate PSNR (Peak Signal to Noise Ratio) values. High value of PSNR indicates high degree of imperceptibility.

The PSNR in decibels is computed between the cover image and the secret message. This ratio is often used as a quality measurement between the original and the secret message. The higher the PSNR, lesser is the difference between the cover image and the secret message.

$$PSNR = 20\log_{10} \left( \frac{MAX_f}{\sqrt{MSE}} \right)$$

MAX<sub>f</sub> is the maximum signal value that exists in the cover image. The PSNR and MSE are calculated for the proposed algorithm after hiding the QR codes generated with secret messages of different sizes in the same image.

When we run the MATLAB code using proposed algorithm the first menu displayed is as follows. (Figure4).



Figure 4 Menu bar displayed during runtime.

When we select the first case “Browse cover image”, a browse window is appeared on the screen. After selecting image the following cover image is appeared on screen (Figure 5).



Figure 5 Cover image for applies the LSB.

In the cover image, a LSB bit to be substituted like 1. The cover image is appeared on the screen using LSB bit substituted by 1 (Figure6).



Figure 6 Cover image after applying LSB bit.

When we select the second case “QR code”, it read a text message. Like

Enter the text message: Dr Bharat Mishra  
After entering the text message, the following QR code is appeared on the screen (Figure7).



Figure 7 QR code image.

When we select the third case “Scramble QR image”, the above QR code is converted in the following unreadable format (Figure8).

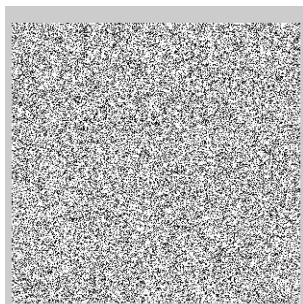


Figure 8 Scrambles the QR code image

When we select the fourth case “JPEG compression”, the above scrambles image is converted in the following JPEG compression image (Figure9).



Figure 9 JPEG compression using DCT on scrambled image.

When we select the fifth case “MSB bit image”, it read the MSB bit. Like

Enter the no of MSB bits to be substituted- 1  
After entering the MSB bit to be substituted by 1, the above JPEG compression image is converted as follows (Figure10).

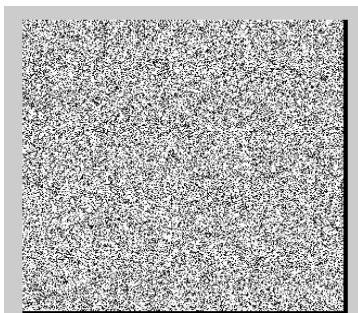


Figure 10 MSB bit image from compression image.

When we select the sixth case “Hide QR scrambled into Cover”, the above MSB bit image embed with the cover image and show the following image (Figure 11).



Figure 11 Hide MSB bit image into LSB bit image.

When we select the seventh case “Extraction”, the above embed image extracted into cover image and scrambled image separately. The scrambled image is shows as follows (Figure 12).

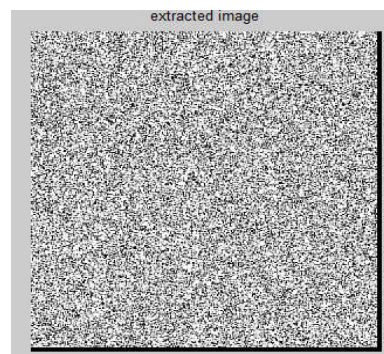


Figure 12 Extracted image (scrambled image) from embedded image.

When we select the eighth case “Descramble image”, the above scrambled image is converted into the following QR code (Figure 13).



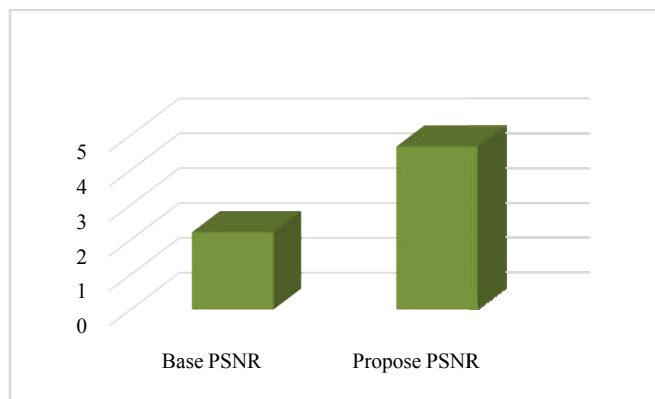
Figure 13 Descramble the scrambled image and we obtain the original QR code image.

When we select the ninth case “Decryption”, the following encrypted message is displayed on the screen from the above QR code.

Enter encrypted: -édS ¾[wé«ULÚ(W  
Decrypted text is: Dr Bharat Mishra  
When we select the tenth case “Calculate PSNR, it calculate the PSNR value and displayed as follows.  
Calculated PNSR: 4.6881

**Table 1** Base PSNR and Propose PSNR

Base PSNR	Propose PSNR
2.2269	4.6881



**Graph 1** Graph.1 Base PSNR and Propose PSNR

Theresults show that the proposed technique works better than the previous technique. The PSNR value of propose is 4.6881 which is the greater than the PSNR value of Base technique.

## CONCLUSION

In this paper, we illustrated the QR Code, it's structure, working, different conceivable application and it's execution in Education. Our analyses demonstrated that it is vital to consider the academic angle when arranging QR exercises. The concentrate ought to be more on the students than on the advancements utilized. This investigation goes for breaking down the conduct of the stego QR code for dark scale and mystery picture and different picture quality measures are watched. LSB bit fundamentally based picture steganographic set of standards has been utilized for various Cover QR. From this investigation it has been discovered that data stowing away in pictures is having great quality stego pictures though data covering up in Grayscale pictures is nearly diminish esteem stego pictures. In any case, as per the mystery and information-implanting limit of the picked Cover QR we might have the capacity to get great quality stego pictures for grayscale pictures moreover. The proposed scheme is implemented in MATLAB platform using standard LSB using cover image and MSB using secret image steganography algorithm and using JPEG compression

## Future Work

Due to the rich availability of picks and the protecting capabilities provided by means of the massive utilization in Internet, malware developers should locate the greatest capacity in community steganography. So the destiny paintings will be viable to make deeper evaluation with a purpose to recognize the steganography procedure of hider guy and masker. The studies may be expanded by means of doing analysis of steganography method of other tools inside the audio and video media record. Identifying the most capability of information that may be hidden in an image the use of a specific steganographic tool needs to be modeled.

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