

Cost Minimization by QR Code Compression

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Abstract— Quick response code is 2D barcode. Now days, it is used for security purpose. But there is some limitation that is data capacity. The maximum capacity of the QR code is 3KB. So increase the capacity of the QR code we use the some compression algorithm. So the main purpose of this paper is to provide the data compression technique for increasing the capacity of quick response code. This is the first time when an image is converted to 2D barcode. Generally size of the image is few KB to MB. But here, we are capable of reducing image size by compression so that it can reduce the size of QR Code.

Keywords— 2D Barcode, QR code, Data compression, Lossless Compression.

I. INTRODUCTION

1D barcode stores the data in only one direction where as 2D barcode are store the information in two direction i.e. horizontal and vertical. So 2D is more powerful barcode. There are some other advantage of two dimensional barcode that is the data can be read easily and write correctly. 2D barcode is very popular for communication, in public relation and security point of view [1]. The durability of 2D barcode is much high as compared to the 1D barcode.

II. QUICK RESPONSE BARCODE

QR stands for quick response code. It is two dimensional matrix barcode developed by the Japanese Corporation Denso Wave in 1994. QR code stores more information as compared to the other barcode such as one dimensional and stacked two dimensional barcode because it store the data in two direction horizontal as well as vertical direction. But there is some limitation of the QR code is used to store the information. For getting the information from QR code we need mobile having camera with special software. This is known as barcode scanner. QR code stores more data as compared to the traditional barcode.

A QR barcode is capable of storing some special type of character alphanumeric character 4296 character and numeric character 7089, binary bytes 2953 and kanji character 1817[2]. Earlier, QR code was generally used in railway ticketing system but now days it is used everywhere. But the main focus of this paper is to provide more storage space in QR code and hence can be fruitful in NoC [3]. We can use any of the compression technique.



Fig. 1 Structure of QR 2D barcode

A. Advantage of Quick Response Code

- High density information
- Store large information
- Store information in both direction
- Allow error correction
- No magnetic tape is used to store in information so cost is reduced.

B. Disadvantage of 2d Code

If we need to read the information that are stored in QR code, it is more difficult because it use some special type of scanner.

Application of Quick Response Barcode

It is used in various fields such as

- Storing URLs
- Business Cards
- Public transport vehicle
- Signature
- Logistic management
- Ticketing system
- Authentication
- Catering orders
- Security application etc.

C. Why We Need Compression In Quick Response Code

In QR code there is some limitation of the storing data. So to increase the capacity of the QR code we use the concept of compression. Image compression addresses the problem of reducing the amount of data required to represent a digital image. Compression is usually of two types one is lossy compression and lossless compression. In this paper we use the lossy compression in QR code. Lossy compression is used to compress the image not for data because the 3KB data is

sufficient for Intrusion detection system. Our main focus is to compress the image. Compression increases the capacity of the QR code for image. . In this paper we compare the original QR code to the compressed QR code.

III. COMPRESSION

Compression is the art of representing information in compact form. It reduces the file size which in turn reduces the required storage space and makes the transmission of data quicker through Bluetooth [4] or any other transmission media. Compression is used to decrease the amount or length of the data that is to be transmitted through antennae [5], Bluetooth or stored anywhere. Basically compression means that to eliminate the redundancy in the data and generally used to reduce the size and it takes less time to transmit the data because of the compressed data.

But, in this paper we use the lossy compression to compress the image because in image there is no effect of the loss data.



Fig. 1 Compression of an image

A. Advantage of Compression in Quick Response Code

There is one limitation of the QR code i.e storage capacity. So overcome this disadvantage, we use the compression concept and extend the capacity of the QR code. Some of the advantage is given below-

- Compression is used to increase the capacity of the QR code.
- It is used to store the large data in QR code.
- It is used for redundant data, when there is redundant data, that data are compressed.
- It takes less time to transfer the data or store the data.
- It uses less disk space.
- It allows faster writing and reading.

B. Types of Compression

Compression is of two types-

- Lossy compression
- Lossless compression

Lossy Compression

As per the name lossy, in the lossy compression the information is loss. In the lossy compression the output is not same as the input. Lossy compression techniques can be used in images where some of the finer details in the image can be sacrificed for the sake of saving a little more bandwidth [6] or storage space.

It is used in that application where loss of some LSB makes no significant change. Lossy compression is generally used in audio and video and we are using the lossy compression to compress the image. So we are using the lossy compression,

we are not using lossless compression. Our first requirement is to compress only image [7]. In our case we have to compress first image then text. There are various advantage and disadvantage of lossy compression.

Advantage of Lossy Compression

- It uses the less space as we remove least significant digit.
- The compression ratio is good.

Disadvantage of Lossy Compression

- In the lossy compression the information is loss.

There is a big advantage of lossy compression so we use the lossy compression to compress the image.

Lossless Compression

When we used the lossless compression [8], information is not lost after the decompression. Lossless compression is some time used for artificial images such as technical drawing. In the lossless compression information is exactly received after the decompression.

Lossless compression is used where is no difference between the actual data or compressed data. Lossless compression refers to compression technique in which the reconstructed data exactly matches the original. It is basically used in medical purpose where the difference between the original data and compressed data are not tolerated.

Lossless compression is used in mainly where the difference between the original data and compressed data are not tolerated.

Advantage of Lossless Compression

- It's lossless so don't loss of any kind of information and the output is exact as input.

Disadvantage of Lossless Compression

- Its use more memory space as compare to the lossy compression.
- Its compression ratio is not good as compare to the lossy compression

Difference Between lossy and Lossless Compression

TABLE I
COMPRESSION BETWEEN LOSSY AND LOSSLESS COMPRESSION

S.No	Feature	Lossy Compression	Lossless compression
1.	Storage Capacity	Less	More
2.	Loss of Information	Yes	No

So we use the compression algorithm in quick response code to compress the image [9]. Using lossy compression algorithm there is no loss of image after the compressed data. The algorithm of compression and decompression algorithm are given below:-

IV. COMPRESSION TECHNIQUE

- There will not be any significant change in the original QR code image. After expansion we get the same string i.e. image without any loss of character. In QR Code, we use alphabets(A-Z), numbers(0-9) and some special characters (\$,space,%,_+,□,_,: ,=). Thus, a total of 45 characters we needed for QR Code.
- Normally, each character in the string is represented by 8-bits. So, if there are 100 characters in a string then we need 800 bits to represent that string.
- Our approach gives each 45 characters a particular code. The code is a fixed length code. We need 6 bits fixed length for each character to distinguish from one another, since $45 < 2^6$.

Compression Algorithm

- 1: String1 is the input and output.
- 2: for each character in String1. do
- 3: Extract a character from the String1.
- 4: Convert this character into respective 6-bit length code.
- 5: Append this code to String2.//Initially String2 is empty.
- 6: end for
- 7: Remainder = (Length of the String2) mod 8.
- 8: Convert (Remainder+1) into 8 bits and add in the starting of String2.
- 9: Add 0's equal to the Remainder at the end of String2.
- 10: for each 8 characters in String2. Do
- 11: Extract 8 characters from the String2.
- 12: Convert this value into equivalent ASCII character.
- 13: Store this character in String1.
- 14: end for
- 15: Return String1

Decompression

Decompression Algorithm

- 1: String1 is the input and output.
- 2: for each character in String1. Do
- 3: Extract a character from the String1.
- 4: Convert this character into respective 8-bit length ASCII code.
- 5: Append this code to String2. Initially String2 is empty.
- 6: end for
- 7: Extract starting 8-bits from String2.
- 8: Convert this into number.
- 9: Remove first 8-bits from String2.
- 10: Remove 0's equal to (number-1) from the end of String2.
- 11: for each 6 characters in String2. Do
- 12: Extract 6 characters from the String2.
- 13: Convert it into equivalent code.
- 14: Store this character in String1.

- 15: end for
- 16: Return String1.

Proposed Approach

In this paper we have the following approach how to generate QR code and how we get the original data from the QR code. This is usually done in two steps.

Step 1: In this step we generate a compressed [10] QR code using various step which that are given below-

- We take a signature as image.
- After that we convert an image in to character format or string.
- Using base 64 algorithm, we compressed the character or string using compression algorithm.
- Finally we get a compressed QR code.

Following flowchart describe the complete generation of the QR code. This is easily understood by the figure 3.

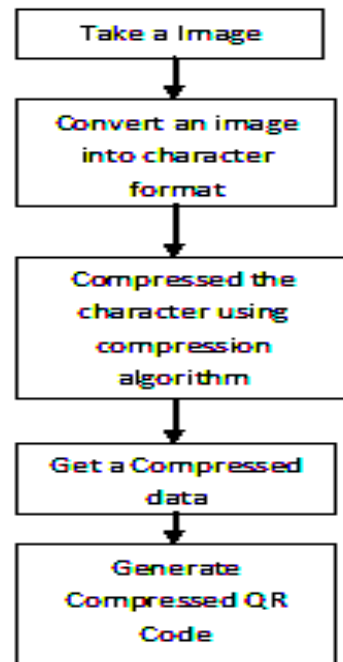


Fig. 3 Flow chart for generating compressed QR code

Step 2: In this step we retrieve the original data after decompression. This is also done by various step.

- We take a compressed QR code.
- After that we retrieve the compressed data that are stored in QR code.
- After that we convert the data in to original data that are stored in QR code.

Complete flow chart that describe the how we generate the original data from the compressed QR code, is easily understood by the figure 4.

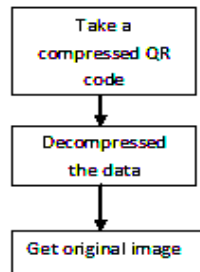


Fig. 4 Retrieve the original data from Compressed QR code

Result:

In this paper, we compare the original QR code with the compressed QR code and information is not lost because we only compressed the image not data. This is done in various steps.

STEP 1: We take an original Signature as image of size is 3 KB. Here biometric can also be used to take finger print like in aadhar card. Aadhar card is basically used for identification of a citizen [11].



STEP 2: After that we convert the image in to the character or string format, as shown in figure 5.

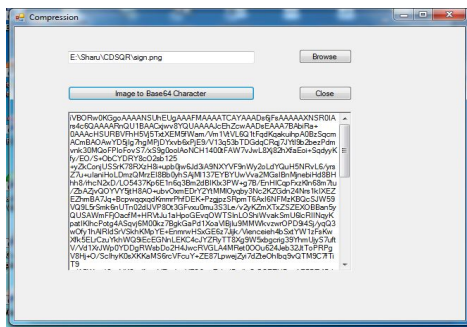


Fig. 5 Character format of QR code

STEP 3: Then we generate the original QR code without any compression algorithm and check the size of QR code as shown in figure 6. So right now we have 17 KB of QR code.

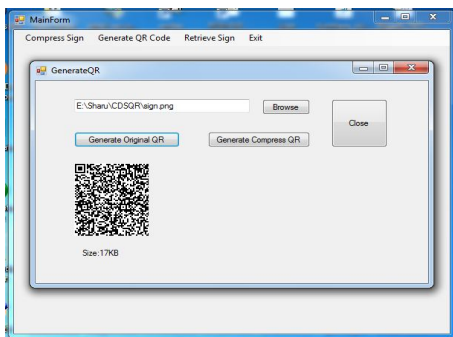


Fig. 6 Original QR code

STEP 4: After that we compressed the data using lossy compression algorithm and generate the compressed QR code of 13 KB and then check the size of the compressed QR code as shown in figure 7.

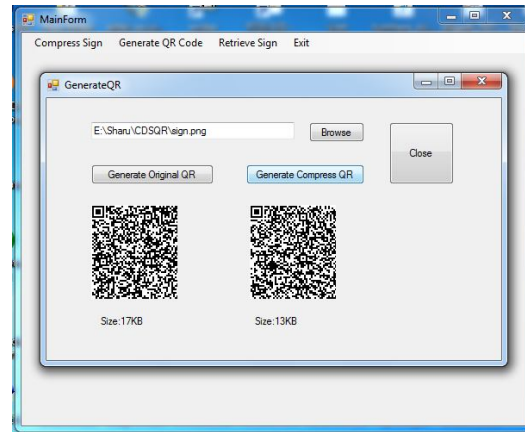


Fig.7 Compressed QR code

STEP 5: Finally we get the original image after the decompression of the QR code. In the final result we see the original image without any loss of the data. So in the image there is no meaning of any type of compression. The main aim is that we compressed the image using any of the technique as shown in figure 8.

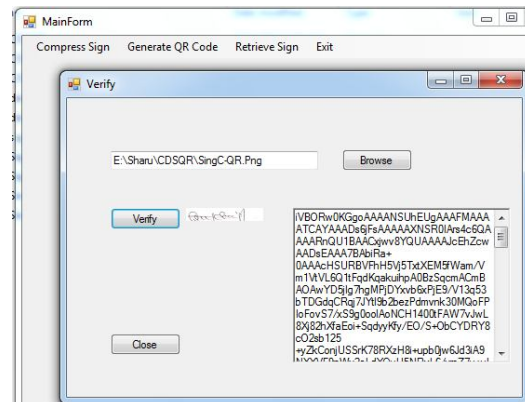


Fig. 8 Character value correspond to signature image

In this result we can say that the compressed [12] QR code is better than original QR code. The size of the original QR code is that 17 KB and the size of the compressed QR code is 13 KB. So it's better and our approach is successful. We can utilize this concept where we want to save the bandwidth [13]

V. CONCLUSIONS

This concept can further be enhancing, by putting the image along with the information given in text. The size of the compression QR code is 13 KB while the size of the Original QR code is 17 KB. After that we get the original image without any loss. So our main purpose is to increase the

capacity of the storage. And this is increased by the compression algorithm.

ACKNOWLEDGMENT

I am grateful to my guide Dr. Ajay Kumar Singh and my parent for giving their full support.

REFERENCES

- [1] Atul Kumar Sharma and Suneeta Agarwal, "A New Approach for Secure Baggage Management at Airport using Encrypted Two Dimensional Barcode", Proc. of the second International conference on Advances in computing, control and communication (CCN) pp. 34-38, 2012.
- [2] Xiaofei Feng, Herong Zheng, "Design and Realization of 2D Color Barcode with High Compression Ratio", International Conference on Computer Design and Applications, Vol. 1, 2010.
- [3] Saurabh Yadav and Ajay Kumar Singh, "NoC Based Approach to Enhance the Existing Network Architecture," International Journal of Soft Computing and Engineering (IJSCE) ISSN: 2231-2307, vol. 2, Issue 4, pp. 159-162, 5th Sept. 2012.
- [4] Kapil Kumar, Prateek Sharma and Ajay Kumar Singh, "Effect on Range of Bluetooth Class 1 Adapter using External Omni Antenna," International Journal of Computer Science and Communication (IJCSC), ISSN: 0973-7391, vol. 3, no. 1, pp. 107-110, Jan.-June. 2012.
- [5] Meenu Gupta, A. K Singh, Manoj Kumar Pal, "Aperture Coupled Patch Antenna Array for Wireless Application", International Journal of Advances in Electrical and Electronics Engineering, ISSN: 2319-1112, vol. 1, pp. 87-96, March 2013.
- [6] Kapil Kumar, Prateek Sharma and Ajay Kumar Singh, "Configuring the System to Share Internet from Single User to Multi-user with Single Internet Dongle," International Journal of Soft Computing and Engineering (IJSCE) ISSN: 2231-2307, vol. 2, Issue 4, pp. 32-35, 5th Sept. 2012.
- [7] Jagadish H. Pujar and Lohit M. Kadlaskar, "A new lossless method of image compression and decompression using Huffman coding techniques", Journal of Theoretical and Applied Information Technology, pp. 18-22, 2005.
- [8] Anmol Jyot Maan, "Analysis and Comparison of Algorithms for Lossless Data compression", International Journal of Information and Computation Technology, Vol. 3, pp. 139-146.
- [9] Prabhakar.Telagarapu, V.Jagan Naveen, A.Lakshmi.Prasanthi, G.Vijaya Santhi, "Image Compression Using DCT and Wavelet Transformations", International Journal of Signal Processing, Image Processing and Pattern Recognition, Vol. 4, No. 3, September, 2011.
- [10] Gaganpreet kaur and sandeep kaur, "Comparative Analysis of Various Digital Image Compression Techniques Using Wavelets", International Journal of Advanced Research in Computer Science and Software Engineering, Vol. 3, Issue 4, pp. 115-123, 2013.
- [11] Saurabh Yadav and Ajay Kumar Singh, "A Biometric Traits Based Authentication System for Indian Voting System," International Journal of Computer Application (IJCA), vol. 65, no.15, pp. 159-162, March 2013.
- [12] Dong Liu, Xiaoyan Sun, Feng Wu, Shipeng Li, and Ya-Qin Zhang, "Image Compression with Edge-Based Inpainting", IEEE Transactions on circuits and system for video technology, Vol. 17, No. 10, October 2007.
- [13] Dr. E. Kannan and G. Murugan, "Lossless Image Compression Algorithm for Transmitting Over Low Bandwidth Line", International Journal of Advanced Research in Computer Science and Software Engineering, Vol. 2, Issue 2, 2012.