**Use of Q-Ary Dimension in 2L QR code to Increase Storage Capacity and Improvise Authentication**

### PROJECT REVIEW REPORT - I

Submitted in partial fulfillment for the award of the degree of

**M.Tech**

***in***

**Software Development & Management**

***by***

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**VIT**

U N I V E R S I T Y

(Estd. u/s 3 of UGC Act 1956)

## School of Information Technology & Engineering [SITE]

September 2017

**DECLARATION BY THE CANDIDATE**

I hereby declare that the project report entitled **“Use of Q-Ary Dimension in 2L QR code to Increase Storage Capacity and Improvise Authentication”** submitted by me to Vellore Institute of Technology, Vellore in partial fulfillment of the requirement for the award of the degree of **M.Tech** [**Software Development & Management]** is a record of bonafide project work carried out by me under the guidance of **Srirama Srinivasa Bommireddypally**. I further declare that the work reported in this project has not been submitted and will not be submitted, either in part or in full, for the award of any other degree or diploma in this institute or any other institute or university.

Place: Vellore Signature of the Candidate

Date: Achal Shrivastava

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###### BONAFIDE CERTIFICATE

This is to certify that the project report entitled **“Use of Q-Ary Dimensions in 2L QR code to Increase Storage Capacity and Improvise Authentication”** submitted by **Achal Shrivastava (15MSD0024)** to Vellore Institute of Technology, Vellore in partial fulfillment of the requirement for the award of the degree of **M.Tech**[**Software Development & Management]** is a record of bonafide work carried out by him/her under my guidance. The project fulfills the requirements as per the regulations of this Institute and in my opinion meets the necessary standards for submission. The contents of this report have not been submitted and will not be submitted either in part or in full, for the award of any other degree or diploma in this institute or any other institute or university.

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Project Review Evaluation Sheet

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| **Components Distribution** | **Marks Awarded** |
| Problem definition, motivation and objective (3) |  |
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Signature of Internal Guide with Name

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### ABSTRACT

Quick Response Code or QR code are quite popular now-a-days for sharing data, including url links, geo coordinates, and text. QR code is the trademark name for the two dimensional barcode system. It was originally invented in 1994 by Denso Wave, a Toyota subsidiary, as a way to track vehicles as they were assembled, and to scan components at high speeds. While Denso Wave does hold the patent on the technology, it has granted free license on it, going so far as to publish the spec online, and allowing anyone to use it.

QR codes can hold 100 times more data than 1D barcodes—they can also be digitally scanned. The block of smaller black and white squares is read by a smart phone's image sensor, then interpreted by the system processor. The encoded data can be interpreted as one of four primary modes—numeric, alphanumeric, byte/binary, and Kanji.

As QR code technology evolved, it began to contain more and more information. The initial version was 21 x 21 pixels and held just 4 characters’ worth of data.

In proposed QR code authentication two level storage is used, which help to verify original content in QR

Code which will not only increase storage but also improve security by providing two layer to traditional QR code.

In this work we will use public and private storage level of document storage. In the public level same standard QR code storage level is explored; which can be readable to any QR code readable device. The private level is built by supplanting the dark modules by particular finished patterns. It consists of information encoded using q-ary code with an error correction capacity.

This allows us not only to increase the storage capacity of the QR code, but also to distinguish the original document from a copy. This authentication is due to the sensitivity of the used patterns to the print-and-scan (P&S) process. The pattern recognition method that we use to read the second-level information can be used both in a private message sharing and in an authentication scenario. It is based on maximizing the correlation values between P& S degraded patterns and reference patterns. The storage capacity can be significantly improved by increasing the code alphabet q or by increasing the textured pattern size. The experimental results show a perfect restoration of private information. It also highlights the possibility of using this new rich QR code for document authentication.

### LIST OF FIGURES

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### INTRODUCTION

## Overview

Quick response codes or QR codes are basically a two dimensional bar codes which are used day by day due to the technological advancements [1].

QR code (abbreviated from Quick Response Code) is the trademark for a type of matrix barcode (or two-dimensional barcode) first designed for the automotive industry in Japan. A QR code (abbreviated from Quick Response Code) is the trademark for a type of matrix barcode (or two-dimensional barcode) first designed for the automotive industry in Japan.

A QR code consists of black squares arranged in a square grid on a white background, which can be read by an imaging device such as a camera, and processed using Reed–Solomon error correction until the image can be appropriately interpreted. The required data is then extracted from patterns that are present in both horizontal and vertical components of the image.

QR codes have become common in consumer advertising. Typically, a smartphone is used as a QR code scanner, displaying the code and converting it to some useful form (such as a standard URL for a website, thereby obviating the need for a user to type it into a web browser).

QR codes have an immense number of utilizations including: data stockpiling (promoting, historical center craftsmanship portrayal), redirection to sites, track and follow (for transportation tickets or brands), recognizable proof (flight traveler data, general store items) and so forth. The ubiquity of these codes is for the most part because of the accompanying elements: they are strong to the duplicating procedure, simple to peruse by any gadget and any client, they have a high encoding limit upgraded by mistake amendment offices, they have a little size and are vigorous to geometrical bends.

One of the popular application of QR codes is multimedia management. This interest is due to several interesting characteristics of QR code: small size, high coding and error correction capacities, robustness against geometrical distortion, easy generation and reading process.

Although it has many advantages but still has many downsides to be improved upon most common disadvantages are: It is easily accessible to anyone even if it is ciphered and it is very difficult to distinguish between the originally generated QR codes with its photocopy. So,

in order to intrude the QR code, any third person can retrieve the information with the help of a standard QR code scanner. As far as message sharing and document authentication are concerned the security of the QR code is our highest priority.

In order to overcome these shortcomings, we have proposed a two level QR code with enhanced encoding technique. This enhancement is achieved by supplanting the dark modules by particular finished patterns which is generated from Q-Ary dimensions. These patterns are sensitive to the distortions created while printing and scanning process.

Our proposed technique also lays emphasis on storage capacity apart from security and privacy. Our proposed system consists of a public level QR code and a private level QR code. It consists of information encoded using Q-ary code with an error correction capacity. Q-Ary code will increase the storage capacity of the QR code, but also to verify the original document from a copy.

The public level QR code can be accesses with the help of any standard QR code scanner whereas the private level QR code cannot be accessed from any standard QR scanner. Hence it provides a level of security against any possible intrusion to greater extent. This information is invisible to the standard QR code reader because it perceives the textured patches as black modules. Therefore, the second level can be used for private message sharing. Additionally, thanks to textured patches sensitivity to P&S distortions, the second level can be used to distinguish the original 2LQR code from its copies. The Reed-Solomon error correction code is used for data encryption. Therefore, one of 4 error correction levels have to be chosen during QR code generation.

This authentication is due to the sensitivity of the used patterns to the print-and-scan (P&S) process. The pattern recognition method that we use to read the second-level information can be used both in a private message sharing and in an authentication scenario. It is based on maximizing the correlation values between P&S degraded patterns and reference patterns. The storage capacity can be significantly improved by increasing the code alphabet q or by increasing the textured pattern size. The experimental results show a perfect restoration of private information. It also highlights the possibility of using this new rich QR code for document authentication.

## Literature Survey

An in-depth writing has a look at turned into finished in the assist of the two stage QR code.

Nancy Victor [3] proposed a technique for data compression which enhances the data capability of QR codes by compressing the data previous to creation of QR codes.

B. Sklar [4] proposed the Reed-Solomon error correction code used for data encryption where one of 4 error correction levels has to be elected during QR code generation.

R. Villán, S. Voloshynovskiy, O. Koval, F. Deguillaume, and T. Pun [5] proposed the combination of strong text hashing and text data hiding technologies as an effective solution to authentication and tamper-proofing of text documents.

T. V. Bui, N. K. Vu, T. T. P. Nguyen, I. Echizen, and T. D. Nguyen [6] proposed a scheme based on reed Solomon codes and list decoding. Using bit technique, it hides secret information and prevents attacker changing any bit of hidden bits.

### PROBLEM ANALYSES

## Existing System

QR codes is featured because they are strong to the copying data and easy for reading with any device and any user, they have a high encoding capacity enhanced by error correction facilities, they have a small size and are robust to geometrical distortions. Although it has some advantages and some disadvantage.

1. Information encoded in a QR code is constantly open to everybody, regardless of the possibility that it is figured and along these lines is just readable to approved clients (the contrast amongst "see" and "get it".

2. The standard QR code is unable to distinguish original document content over duplicate copy of encoded document. To overcome above drawback this project report is motivate to standard QR code encoding capacity. This enrichment is obtained by replacing its black modules by specific textured patches form cover image. Besides the gain of storage capacity, these patches can be designed to be sensitive to distortions due to the P&S process. These patches that do not introduce disruption in the standard reading process are always perceived as black modules by any QR code reader. Therefore, even when the private information is degraded or lost in the copy, the public information is always accessible for reading.

**Disadvantages:**

* 1) Storage size is high. So it cannot save the storage capacity.
* 2) It cannot restore the private information perfectly.
* 3) While Compression, important information removed.

## Proposed System

Proposed system is based on double levels (public and private level) QR for data hiding. The public level QR code can read text or document easily with reader, but the private level needs a specific device with encoded information. This 2LQR code can be used for private message sharing or for authentication mechanism. When this two level QR code is scanned from any standard QR scanner, only the public message will be shown from the scanner whereas the private message will be safe, secured and hidden. The standard QR code has white and black modules and 2LQR code has white modules and patterned modules instead of black modules. This pattern module contains message, encoded with q-ary (q ≥ 2) code with error correction capacity. These textured modules have specific features and are used for private message Mpriv storage in the proposed 2LQR code.

The proposed techniques can conceal the important information into the cover QR code without distorting the readability of QR content. That is, general browsers can read the QR content from the marked QR code to reduce attention. Only the authorized receiver can encrypt and retrieve the secret from the marked QR code.

The storage capacity of the 2LQR code can be improved by decreasing the pattern patches size.

**Advantages: -**

* 1) This proposed technique offers significant enhancement of the data capacity.
* 2) Restoration of private information is perfectly.
* 3) Lossless compression with no information lost.

## Approach

The primary problem is to implement an efficient, robust, scalable, and easy to use authentication system. The proposed system consists of:

1. Public message (Can be read by any QR code reader)
2. Private Message (Encoded with q-ary (q ≥ 2) code with error correction capacity)
3. Black module replacement.

### ARCHITECTURE

## System Architecture

**2 Layer QR code with Q-ary Dimension**

PRIVATE INFORMATION

TEXT/DOCUMENT(Mpriv)

PUBLIC INFORMATION

INPUT TEXT/DOCUMENT(Mpriv)

Pattern Selection

Q-ary Dimensions

Binary error correction code(ECC) such as Golay code, BCH codeor Reed-Solomon code

Standard QR Code generation using (Reed-Solomon )

Special Patterns

P1,p2,…

Codeword Csup

Adding function pattern

(position tags, alignment, timing, format and version patterns)

**Scrambling**

Scrambled Codeword Csp

Supplanting the dark/black modules in QR code by Pattern P1,P2,.. and

Scrambled codeword

Fig:3.1

## Module Description

**MODULE 1: INPUT MESSAGE.**

This is our first module. In this module, we will be giving the public and private messages as an input.

**MODULE 2: STANDARD QR CODE GENERATION.**

In this module, we will generate a standard QR code which will be created by encoding the public message.

First of all, the most optimal mode (numeric, alphanumeric, byte or Kanji) is selected by analyzing the message content. The message is encoded using the shortest possible string of bits. This string of bits is split up into 8 bit long data code words. Then, the choice of error correction level is performed and the error correction code words using the Reed-Solomon code are generated.

After that, the data and error correction codewords are arranged in the correct order. In order to be sure that the generated QR code can be read correctly, the best (for encoded data) mask pattern is applied.

After this manipulation, the code words are placed in a matrix in a zigzag pattern, starting from the bottom-right corner. The final step is to add the function patterns (position tags, alignment, timing, format and version patterns) into the QR code.

This QR code can be scanned by any standard QR code scanner. As far as standard QR is concerned, there is a pre-defined, library ―Zxing‖ which has to be directly imported. That Library has got all the predefined methods in order to create a QR code.

We just have to import a jar file known as Zxing’s core.jar file from Maven repository.

Any QR code generated using the Zxing library can be easily scanned by a standard QR scanner

**MODULE 3: PATTERN GENERATION.**

The private row-bit string is encoded using error correction code (ECC).

In this module, the private row-bit string is encoded using error correction code (ECC) to ensure the message error correction after the P&S operation. We use the block codes, and more precisely cyclic codes (or polynomial-generated codes) such as Golay code or Reed-Solomon code, for message encoding.

**MODULE 4: REPLACEMENT OF DARK MODULES OF THE STD. QR CODE WITH THE GENERATED PATTERNS.**

In 2LQR code black and white modules are represented using zeros and ones. Cell is divided into 24x24 pixel size. Check for zeros and whole of the zeros will be replaced with code. The textured pattern which replaces the black modules is based on the number of zeros available. For example, if there are 5 zeros then 5 squares corresponding to that will be drawn while encoding. During decoding the same 5 squares will be decoded as 5.

## Algorithms Used

1. Reed-Solomon error correction code

QR code generation algorithm consists of information encoding using Reed-Solomon error correction code, information division on code words, application of mask pattern, placement of code words and function patterns.

Reed Solomon codes are a subset of BCH codes and are linear block codes. A Reed-Solomon code is specified as RS(n,k) with s-bit symbols.

This means that the encoder takes k data symbols of s bits each and adds parity symbols to make an n symbol codeword. There are n-k parity symbols of s bits each.

A Reed-Solomon decoder can correct up to t symbols that contain errors in a codeword,

where 2t = n-k.

1. QR Encoding Algorithm

* Enter the user’s data to generate the QR code
* Convert the entered data into its ASCII equivalent
* Using the ASCII equivalent Finite Fields Numbers are generated by using Primitive polynomial
* Code word is generated for the Finite Field numbers using RS encoder algorithm
* The code word is converted into its binary Equivalent 6. These bits are placed according to the QR code pattern

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