

**PAPER BASED DOCUMENT  
AUTHENTICATION USING QR CODE AND  
SMART PHONE**

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**Submission date: 11/06/2021**

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## **APPROVAL**

This thesis titled on “paper based document authentication using qr code and smart phone” submitted by Name: Omer Faruk, ID: 171-35-187 to the department of Software Engineering, Daffodil International University has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of Bachelor of Science in Software Engineering and approval as to its style and contents.

## DECLARATION

It hereby declares that this thesis has been done by me under the supervision of Nayeem Hasan. Lecturer, Department of Software Engineering, Daffodil International University. It also declares that neither this thesis nor any part of this has been submitted anywhere else for award of any degree.

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## **ACKNOWLEDGEMENT**

I have taken endeavors in this thesis. Be that as it may, it would not have been conceivable without the kind help of numerous people. I might want to stretch out my earnest because of every one of them. I am exceptionally obligated to Daffodil International University for their direction and steady supervision by Nayeem Hasan. I would like to express my gratitude towards our parents, our batch mate, and member of DIU for their kind co-operation.

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## **LIST OF ABBREVIATIONS**

QR = Quick response.....	12
ISO = International standard organization.....	11
IEC = International electrotechnical organization.....	11
ASCII = American standard code.....	11
API = Application programming interface.....	18

## ABSTRACT

In our country paper based documents or certificates are still used more in office-court or our daily life. For example documents issued by the government such as birth registrations, passports, death certificates, driving licenses, all educational certificates etc. These documents or certificates can be easily cheated by using advanced scanning and printing technologies. As a result, the people of our country are often deceived in many places. In this paper an application of paper-based document authentication is showed. The purity of the data and the author of the document or certificate can be authenticate with the use of QR code and smartphone. This proposed method can be automatic.

**Key words:** QR code, Paper based document, authentication.

## 1. INTRODUCTION

The trend of e-office and e-government has grown rapidly. Though there are many questions about security and authenticity of e-documents. But there are needs for certain types of work that are still needed to be communicated in a form of paper based documents. For example, certificate or documents issued by government such as birth certificate, death certificate, driving license, all educational certificate, all medical test result etc.[1]

With the advanced technology of digital printing and advanced scanning techniques that can be made at low costs but has very high efficiency and quality, offenders can easily make counterfeit documents for defrauding. It is difficult to understand if the document is original or duplicate. By use of modern technology and equipment such as



scanners, printers etc. it is regarded as a threatened danger for our country. [2]

Authenticating paper based documents usually need an expert. This completely rely on the ability of the specialist who can verify the documents or certificates. There are a lot of ways to authenticate documents in the area of forensic science in many countries. This way needs special equipment such as a UV lamp, a magnifying glass etc. It is very difficult for an organization or an institute which has a large number of documents needed to authenticate quickly. In this paper an implementation of paper-based document authentication is presented.

## **1.1 OBJECTIVE**

The main objective of this paper is to eliminate paper based document fraud from the country.

Specific objectives:

1. The first objective of this thesis work is to study the concept of QR Code in details.
2. Then focus on how to use QR code in documents in an easy technique.
3. To identify barriers and concerns related to paper based documents or certificates.
4. To study details about google sheet and base 64 function.
5. Develop a secure system for verifying paper based documents.
6. Trying to develop the system in an easy way.

## **1.2 RESEARCH QUESTIONS**

In order to focus our work on specific tasks and clearly determine the purpose of our research we state a set of research questions on which our study will be based. These questions is given below:

1. What is QR code? What are the main technologies of QR code?
2. What are the security issues related to QR code and?
3. Is it possible to attack a QR Code?
4. What is a paper based document?
5. Is it important to authenticate the paper based documents?
6. Why do we use QR code for authentication?
7. Is it possible to authenticate the paper based documents using QR code?

## **2. LITERATURE REVIEW**

An overview of related literature with document authentication. Researchers are developing different types of document authentication methods. On thin paper they developed a system for managing user's documents by uploading them on cloud databases making them available to respective users by sharing an encrypted QR code. Also a smartphone is used to authenticate the certificate or documents.

According to a joint technical committee of the International Organization for Standard (ISO) and the International Electrotechnical

commission (IEC) QR code is a matrix of symbology [11]. The symbols consist of an array of nominally square modules arranged in an overall square shape, including a unique shape situated at three angles of the symbol and meant to support in simple location of its position, size and turn. It has four levels of error correction for identifying errors. Main dimensions are user-specified to enable symbol production by variety of techniques.

Different researchers have developed almost the same type of authentication method. They use digital signature, hash algorithm, QR code and smart phone for developing the authentication method. Which is very costly, needs more time and needs experts to build the method. But I prepared a method for authentication which is very easy to build and it is not very costly. To build this system we need a base64 function, google sheet, QR code and a smart phone which has a QR code scanner.

### **3. BACKGROUND AND RELATED WORK**

This chapter gives an idea about background information related to this paper like 64 base function, QR code etc.

#### **3.1 BASE 64 FUNCTION**

In programming, Base64 is a set of binary-to-text encoding instances that provide binary data (more particularly, a sequence of 8-bit) in an ASCII string lay-out by translating the information into a radix-64 format. The term Base64 originates from a generic MIME data transfer encoding. Each non-final Base64 digit provides exactly 6 bits of data. Three 8-bit bytes (i.e., a total of 24 bits) can therefore be provided by four 6-bit Base64 digits.

Common to all binary-to-text encoding instances, Base64 is schematic to carry data gathered in binary manner across channels that only reliably help text content. Base64 is especially prevalent on the World Wide Web, where its uses include the capability to attached image files or other binary assets inside textual assets such as HTML and CSS files.

## **3.2 QR CODE**

### **3.2.1 BASICS OF QR CODE**

QR stands for “Quick Response.”

Though QR code is look simple, but QR codes are capable of storing lots of valuable data for you. But no matter how much QR code store, when scanned it, the QR code should give the user access data instantly and that’s why it’s called a Quick Response code.

QR Code is a basically barcode or machine readable code of two vectors. It is scanned by two vectors. Vertically and horizontally. It can be kept dated with more than one vector barcode. Therefore, it is suggested QR code needs more developed technology of reading. QR code is identified by ISO/IEC 18804 Industrial specification. However, it was created and protected by Denso Wave Japanese Corporation 1994. The main aim is to develop this technology to support users to encode and read their own information easily. As shown in Figure 1. [3]

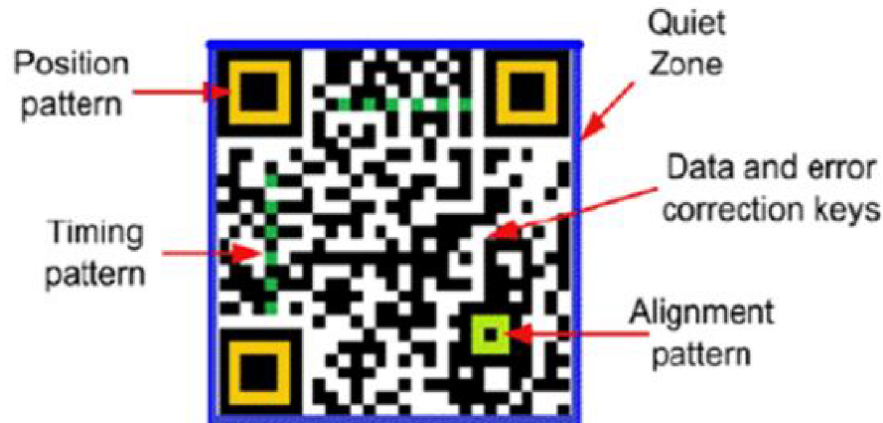


Figure – 1: Basics of QR code

### 3.2.2 QR CODE TECHNOLOGY

QR code changed the possible usage and motive of the coded character. It stored bi-vectors messages while the traditional barcode consisted of one vector of information that is the vertical one [4]. The procedure to identify QR code are:

- ✓ Detecting outer points.
- ✓ Identify shape.
- ✓ Recognize the control bar of QR code.
- ✓ Find barcode aim.
- ✓ Vectors and bit severity to use barcode.
- ✓ Within the QR code, there is area store data area enchipper by Binary numbers[5]

### 3.2.3 ADVANTAGES OF APPLYING QR CODE

- ✓ Open source techniques.
- ✓ Free applications.
- ✓ Easy running procedure
- ✓ User simple process.

It need no difficult nor special familiarity of users to apply QR code. [3]

## **4. DESIGN OF PAPER BASED DOCUMENT AUTHENTICATION**

In this section the design of paper based document authentication using QR code is presented. By using this proposed idea, the validity of certificates can be verified.

### **4.1 CREATING PROCESS**

There are kinds of ways to use QR code, generate QR code and by using QR code for validation. I am familiar with google sheet so I chose it to create QR code with the help of google API. At first I made a data sheet about student certificate details and created a reference value using base 64 function for each student for validation. Then using autocrat create each student certificate with QR code. Then I am writing a code for validation and then the code and data sheet host the same folder for validation.

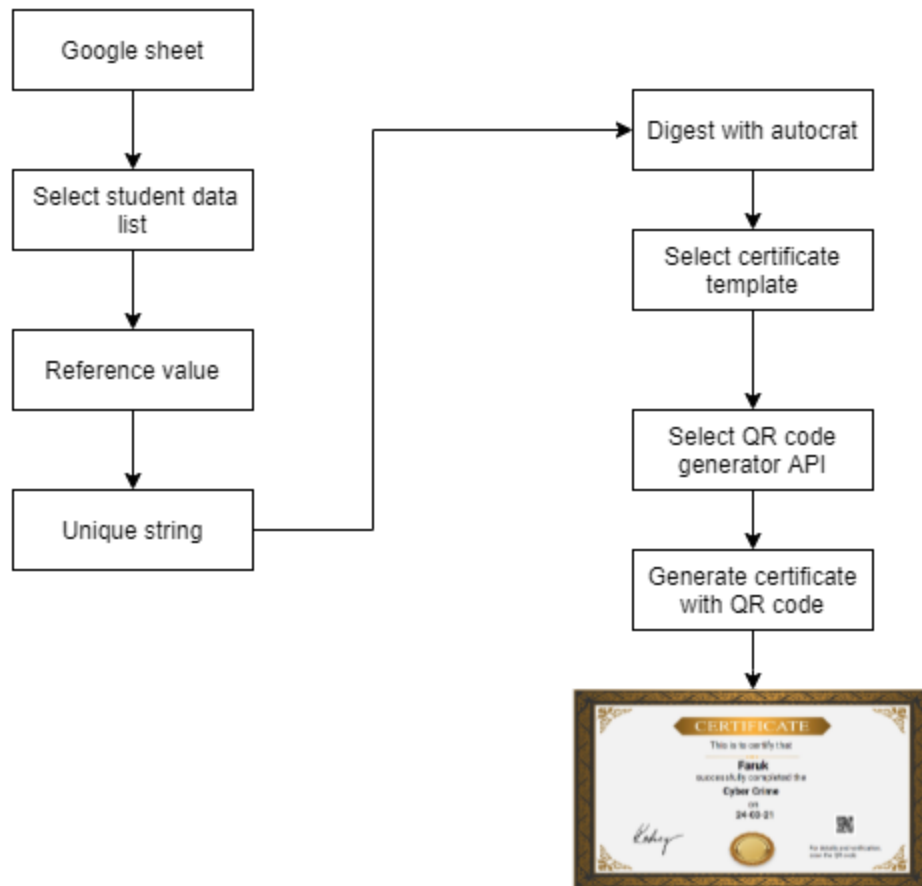


Figure – 2: Certificate create process

## 4.2 AUTHENTICATION PROCESS

For certificate or documents authentication we need a smartphone with a QR code scanner. Then we select a certificate for wanted authentication and need to scan the QR code of the certificate. After the scan, if the certificate is authenticated it is brought to a web site showing the details about the desired certificate and if the certificate is invalid then it shows your certificate is unauthenticated. The process of certificate authentication is shown in figure 2.

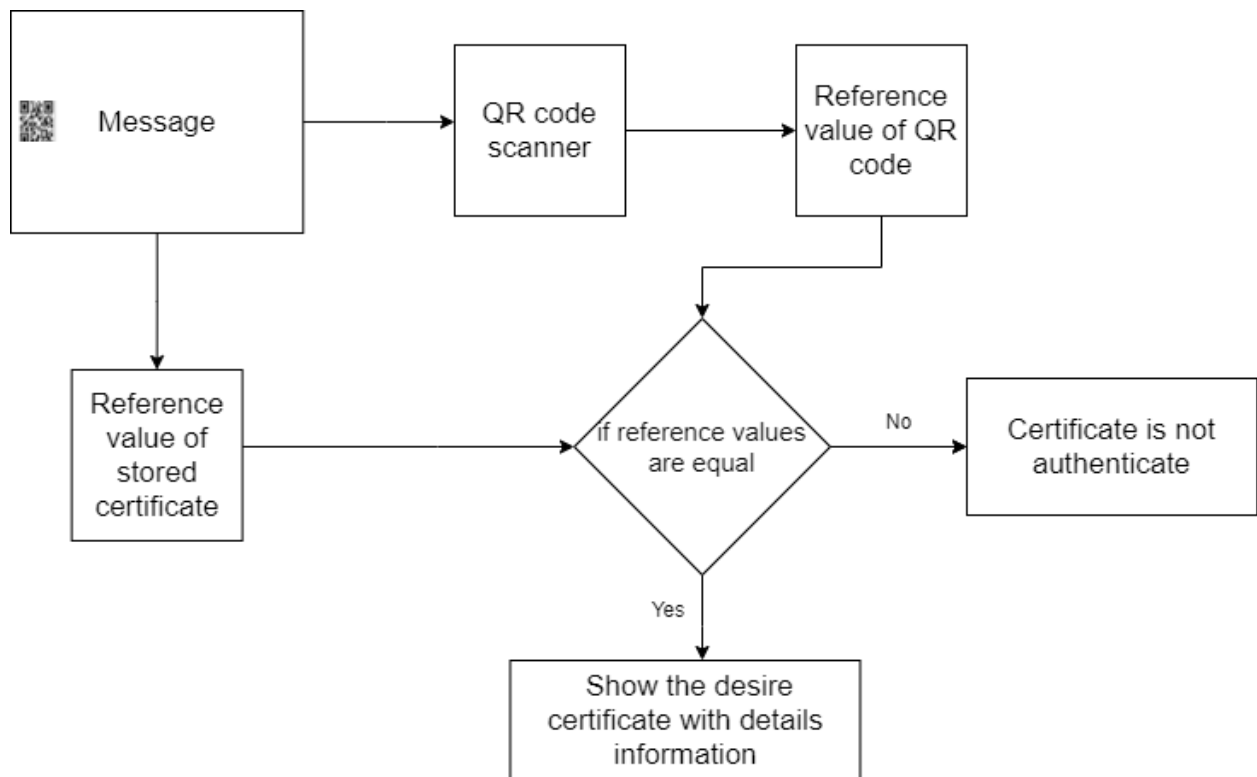


Figure – 3: Process of authentication

## 5. SECURITY ANALYSIS

In this chapter the security analysis of paper based certificate or document authentication is presented. With the use of QR code and a reference value which is created using base 64 function and use of a code it's very secure and easy for authentication.

### 5.1 AUTHENTICATION



The reference value which is generated by the use of base 64 function and the code for validation is hosting a server. So if anyone find the QR code's reference value (though it is impossible) but he cannot authenticate the certificate. So the authentication process of paper based certificate or document authentication is very secure.

## **5.2 INTEGRITY**

The reference value QR code is the digital fingerprint of the certificate. If the QR code is altered but the reference value couldn't be altered. Without a reference value the attacker could not modify the details about the certificate.

## **5.3 NON-REPUDIATION**

The host reference value and the QR code's reference value are mathematically related. Certificate details show when the two reference values are equal. The user cannot deny the reference value for certificate authentication.

## **6.0 VERIFICATION AND EXPERIMENTAL RESULT**

Verification of cloud server offers powerful verification and authentication of information. By using QR code information should authenticate easily while maintaining the elevated security. It is very difficult for an attacker to hack the secret data. If the attacker able to obtains the secret data in the server, then it is quite impossible to recover the secret information.[6]

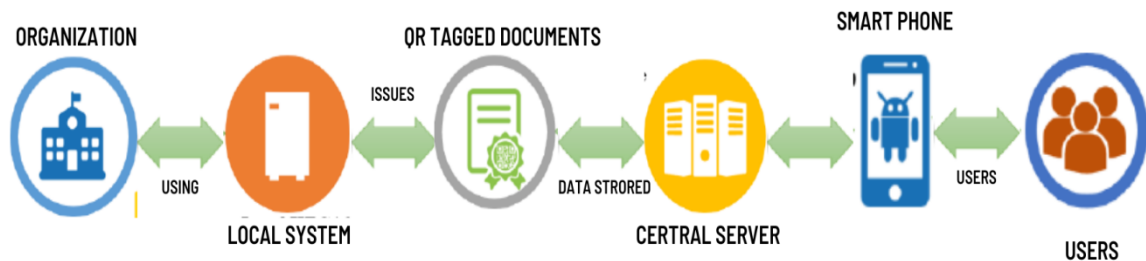


Figure – 4: Total work flow

A prototype system to accomplish to authenticate proposed method. This proposed system will developed with PHP programming language and with the help of google sheet google sheet is very easy to use. Google sheet has a build-in base 64 function which is create a unique hash value or unique reference value for each certificate or each documents. And it will help to authenticate each certificate or documents by using PHP programming language. The data part of the scanned image is go through an OCR and its unique reference value is compared with the hosting unique reference value. If the both unique reference value is matched, then it show the certificate is valid.



Figure – 5: Certificate with QR code

# Certificate Details



## Information

<b>Certificate Number</b>	12345
<b>Name</b>	Faruk
<b>Designation</b>	Student
<b>Institute</b>	DIU
<b>Workshop Organiser</b>	DIU
<b>Workshop Name</b>	Cyber Crime
<b>Workshop Date</b>	24-03-21

Figure – 6: Certificate details and verification

The table below show the experimental result of proposed method.

<b>Serial No.</b>	<b>QR code</b>	<b>Size and location of damage</b>	<b>Error</b>	<b>Success</b>	<b>smartphone</b>
1	Fresh QR code	-	0	Yes	Samsung galaxy A20
2	Fresh QR code	-	0	Yes	Techno
3	Damaged QR code	0.5 inch at the center	0	Yes	Samsung galaxy A20
4	Damaged QR code	0.3 inch at the bottom	0	Yes	Samsung galaxy A20
5	Damaged QR code	2 inch at right	1	No	Samsung galaxy A20
6	Damaged QR code	0.9 inch at center	1	No	Samsung galaxy A20

Table 1: Experimental result

In the table 1, if the error is 1 then the QR code is unreadable and if the error is 0 the QR code is readable. Although every students takes care of their valuable documents or certificate.

## CONCLUSION

Validity check of paper-based documents or certificate is now important because certificate can be cheated easily by using modern technique. This paper goal is to develop an easy and secure electronic system to check the validity of the valuable certificate or documents. Using QR code technology and the verification process of paper-based document at online mode. This method is not very costly and it help any organization or institute to verify their student's certificate or documents without any hassle. It is faster than manual verification and it prevents the creation of fake documents or certificates. The proposed method can be done automatically if the QR code is accurate.

## REFERENCES:

- [1]R. L. van Renesse, “Paper based document security - a review,” in *European Conference on Security and Detection - ECOS97 Incorporating the One Day Symposium on Technology Used for Combatting Fraud*, London, UK, 1997, vol. 1997, pp. 75–80. doi: 10.1049/cp:19970425.
- [2]U. Garain and B. Halder, “On Automatic Authenticity Verification of Printed Security Documents,” in *2008 Sixth Indian Conference on Computer Vision, Graphics & Image Processing*, Bhubaneswar, India, Dec. 2008, pp. 706–713. doi: 10.1109/ICVGIP.2008.67.
- [3]M. A. U. Naser, E. T. Jasim, and H. M. Al-Mashhadi, “QR code based two-factor authentication to verify paper-based documents,” *TELKOMNIKA*, vol. 18, no. 4, p. 1834, Aug. 2020, doi: 10.12928/telkomnika.v18i4.14339.
- [4]Yue Liu, Ju Yang, and Mingjun Liu, “Recognition of QR Code with mobile phones,” in *2008 Chinese Control and Decision Conference*, Yantai, Shandong, China, Jul. 2008, pp. 203–206. doi: 10.1109/CCDC.2008.4597299.
- [5]J. Z. Gao, L. Prakash, and R. Jagatesan, “Understanding 2d-barcode technology and applications in m-commerce - design and implementation of a 2d barcode processing solution,” in *31st Annual International Computer Software and Applications Conference - Vol. 2 - (COMPSAC 2007)*, Beijing, China, Jul. 2007, pp. 49–56. doi: 10.1109/COMPSAC.2007.229.

- [6] “QR code based two-factor authentication to verify paper-based documents” TELKOMNIKA Telecommunication, Computing, Electronics and Control Vol. 18, No. 4, August 2020, pp. 1834~1842
- [7] “Understanding 2d-barcode technology and applications in m-commerce - design and implementation of a 2d barcode processing solution”. 31st Annual International Computer Software and Applications Conference - Vol. 2 - (COMPSAC 2007)
- [8] U. Garain and B. Halder, “On Automatic Authenticity Verification of Printed Security Documents,” in *2008 Sixth Indian Conference on Computer Vision, Graphics & Image Processing*, Bhubaneswar, India, Dec. 2008, pp. 706–713. doi: 10.1109/ICVGIP.2008.67.
- [9] QR Code Tutorial, <http://www.thonky.com/qr-code-tutorial>
- [10] High Capacity Color Barcode, [http://en.wikipedia.org/wiki/High\\_Capacity\\_Color\\_Barcode](http://en.wikipedia.org/wiki/High_Capacity_Color_Barcode).
- [11] International Organization for Standardization ISO/IEC 18004 Information technology - Automatic identification and data capture techniques - Bar code symbology - QR Code, [http://raidenii.net/files/datasheets/misc/qr\\_code.pdf](http://raidenii.net/files/datasheets/misc/qr_code.pdf)



[12]

QRStuff,<http://www.qrstuff.com/blog/2011/01/18/what-size-should-a-qr-code-be>

[13]

QR Codes,<http://www.qrcode.es/en/2013/12/%C2%BFcual-es-el-tamano-minimo-de-un-qr-code/>

[14]

[www.computer.org/csdl/proceedings-article/icoit/2016/07966807/12OmNqzu6Vk](http://www.computer.org/csdl/proceedings-article/icoit/2016/07966807/12OmNqzu6Vk)

[15] “Degree Certificate Authentication using QR Code and Smartphone”. International Journal of Computer Applications (0975 – 8887)

Volume 120 – No.16, June 2015

[16] QR code based two-factor authentication to verify

paper-based documents”. 1693-6930, accredited First Grade by Kemenristekdikti, Decree No: 21/E/KPT/2018

[17] “Paper-based Document Authentication using Digital Signature and QR Code”. 2012 4TH International Conference on Computer Engineering and Technology (ICCET 2012)

[18] “Higher Educational Certificate Authentication System Using QR Code Tag”. International Journal of Applied Engineering Research

ISSN 0973-4562 Volume 12, Number 20 (2017) pp. 9728-9734  
Research India Publications. <http://www.ripublication.com>

[19] “Secure Authentication for Online Banking Using QR Code”.  
International Journal of Emerging Technology and Advanced  
Engineering

Website: [www.ijetae.com](http://www.ijetae.com) (ISSN 2250-2459, ISO 9001:2008 Certified  
Journal, Volume 4, Issue 3, March 2014)

[20] Harshal Pandit Shailendra Nipane, Suraj Jadhav, Sunita Naik  
Secured E-Document and Sharing using Encrypted QR-Code [Journal] //  
International Journal of Computer Applications (0975 -8887). - July  
2016. - pp. 15-19.

[21] What Size Should A Printed QR Code Be? [Online] //  
QRSuff.com. - 06 3, 2017. -  
<https://blog.qrstuff.com/2011/01/18/what-size-should-a-qr-code-be>.

[22] Ankit Singhal R.S Pavithr Degree Certificate Authentication using  
QR Code and Smartphone [Journal]. - [s.l.] : International Journal of  
Computer Application (0975-8887), June 2015. - Vols. 120-No. 16.

[23] David Muñoz-Mejías, Ivan Gonzalez Diaz, Student Member, IEEE,  
and Fernando Diaz-de-Maria , Member, IEEE ,“A Low-Complexity  
Pre-Processing System for Restoring Low-Quality QR Code  
Images”, 2011.

[24] David Pintor Maestre Universitat Oberta de Catalunya 08018,  
“QRP:

An improved secure authentication method using QR codes”,

Barcelona, June 8, 2012

[25] International Journal of Emerging Technology and Advanced Engineering. Website: [www.ijetae.com](http://www.ijetae.com) (ISSN 2250-2459, ISO 9001:2008 Certified Journal, Volume 4, Issue 3, March 2014)778.

“Secure Authentication for Online Banking Using QR Code Sonawane Shamal<sup>1</sup>, Khandave Monika<sup>2</sup>, Nemade Neha<sup>3</sup>”. B.E computer engineering, Institute of Knowledge College of engineering, pune.