DOCUMENT AUTHENTICATION

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Objectives

The purpose of this diploma thesis is to create a system which ensures the authenticity of a document. For this purpose, the contents of the document are saved in QR codes which then accompany it. Thus, the main objective is the implementation of a system that successfully recognises the differences between an authentic and an altered document, based on the contents of the aforementioned barcodes.

Introduction

Document authentication is a topic that has been studied for years now. Documents' wide use, as well as their often sensitive content, make their authenticity a necessity. Governmental, academic, banking and other certificates are only some types of documents which contain information that needs to remain unaltered. On the other hand, their nature makes any type of alteration very easy. Additionally, the existence of computers makes it crucial to take into account the authenticity of documents in electronic form too.

The use of barcodes and especially QR codes has been spread rapidly in recent years. Their usefulness derives from the information storage in them and the data retrieval via barcode decoding. Additionally, no extra equipment is required for their use – only a computer or a smartphone is needed. Therefore, the choice to use QRs for document authenticity is completely logical.

Method

The content of the document is segmentated and compressed. Afterwards, it is saved in multiple QR codes, which are then placed in extra pages. Additionally, a barcode is put in the original image, as an extra precaution.

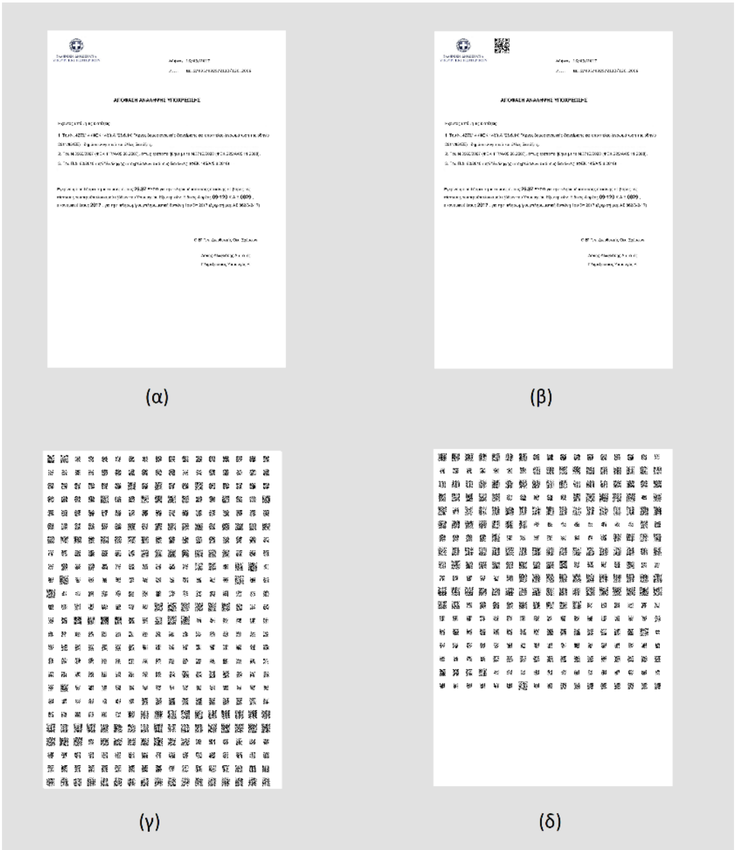

Figure 1: The document and its accompanying QR codes

When a document is examined in regards to its authenticity, the QR codes are detected and decoded. The original document is reconstructed and then compared to the one that is under examination. The two criteria regarding its authenticity, are the total number of black pixels and the number of commonly coloured pixels in the two images.

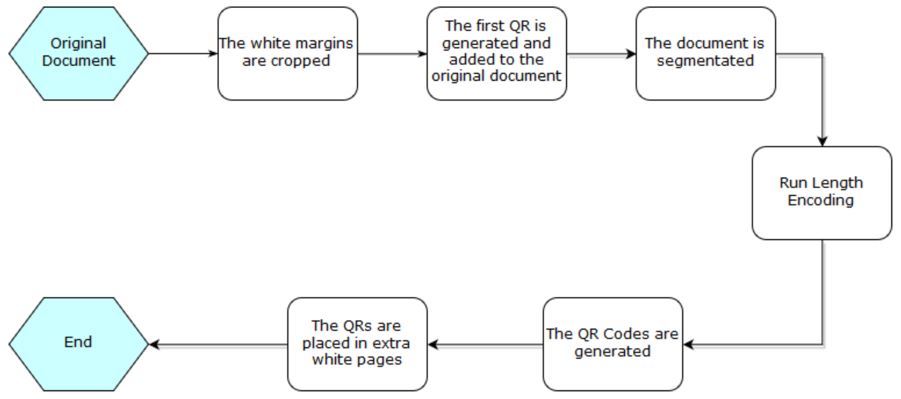
Original Document
The white margins are cropped
The first QR is generated and added to the original document
The document is segmentated
Run Length Encoding
The QR Codes are generated
The QRs are placed in extra white pages
End

Figure 2: The document protection process

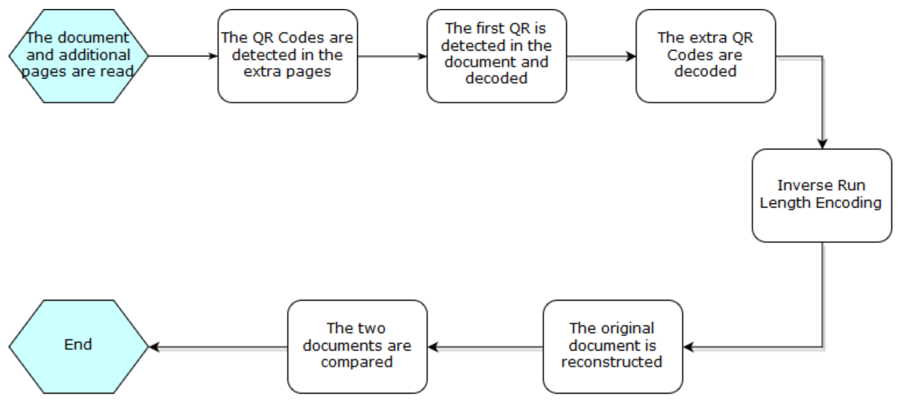
The document and additional pages are read
The QR Codes are detected in the extra pages
The first QR is detected in the document and decoded
The extra QR Codes are decoded
Inverse Run Length Encoding
The original document is reconstructed
The two documents are compared
End

Figure 3: The document authenticity control process

Results

The document protection has a 98,1% hit rate. Regarding the authenticity control, three metrics are used:

1) The total hit rate, meaning the total number of correct results.
2) The false positive rate, meaning the number of documents that are falsely pronounced authentic.
3) The false negative rate, meaning the number of documents that are falsely pronounced altered.

These metrics are calculated for each of the document comparison methods – comparison of total black pixels and comparison of similarly coloured pixels – as well as their combination.

The tables below presents the above metrics for the selected database.

Comparison of black pixels	
Hit rate	93%
False positive rate	9,7%
False negative rate	0,9%

Table 1: Results of the first method of authenticity control

Comparison of similarly coloured pixels	
Hit rate	97,6%
False positive rate	0,9%
False negative rate	5,4%

Table 2: Results of the second method of authenticity control

Combination of the two methods	
Hit rate	98,5%
False positive rate	0,9%
False negative rate	2,7%

Table 3: Results of the combination of the two methods of authenticity control

Conclusion

Using the above techniques, the implementation of a document authenticity control system can be achieved. The error rates are quite low, a fact which proves the efficiency of the proposed method. Finally, the correct authenticity control in rotated documents is the next step in the development of this method.

References

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2 Eldefrawy M. H., Alghathbar K., Khan M. K., «Hardcopy Document Authentication Based on Public Key Encryption and 2D Barcodes», 2012 International Symposium on Biometrics and Security Technologies, Taipei, pp. 77-81, 2012.

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