

able to recognize a single trace of the QR code, satisfying its conversion into stationary white-noise data.

The encrypted information now can be sent to a user, together with the encoding key R_2 . Obviously, the retrieved QR Code (Fig. 4(d)) presents the natural speckle noise due to the optical processing with random phase mask.

5. Decoded results, comparison to previous methods, and potentials

Precisely the speckle noise generates a reduction in the original quality of the object, thus inducing the potential clients of the method to be reluctant to widely accepting it for their operations.

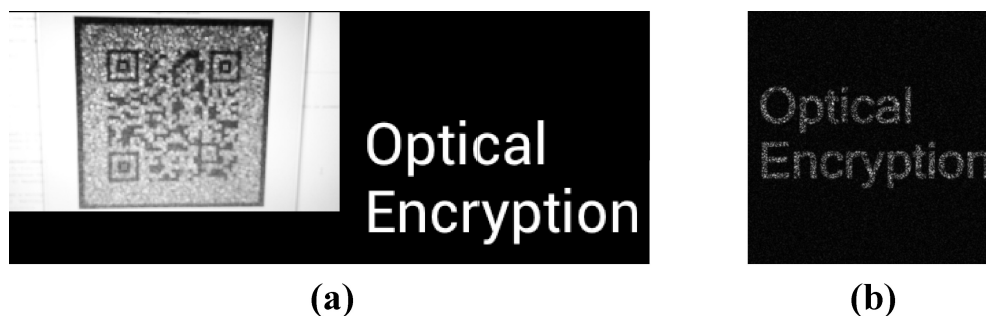


Fig. 5. (a) Reading of the decrypted QR Code revealing the noise-free message and (b) recovering of the message using only optical encryption.

Nevertheless, and thanks to the error correction levels, the direct scan of Fig. 4(d) reveals the result of Fig. 5(a), that is a recovered input with total resemblance with the original information, and totally noise-free. Figure 5(b) presents the noisy decrypted image with the traditional DRPE optical encryption technique. Figure 5(a) actually is the demonstration of a noise-free recovered message when employing optical encryption and QR coding together, thus proving the great potential of this contribution.

In this contribution, we only intend to introduce the concept, thus deferring the logical optimization of the whole procedure to future contributions.

Extensions can be envisaged as to comprise multiplexing options, involving the practical solutions already found in this context as to avoid cross talk and residual noise. Even dynamical approaches could be intended, supported in future developments dealing with QR synchronization in collecting the individual frames to launch a movie.

In this sense, we believe this novel application merging the QR code to the optical encryption revitalizes the traditional optical encrypting methods. According to our criterion, our technique represents an advance in presenting a practical tool, which can be massively used, and solving the drastically issue of the ever present speckle noise altering the outcome.

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