International Circle of Educational Institutes for Graphic Arts: Technology and Management
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The future of print, online and mobile media with use of individualised QR codes in V and NIR spectrum

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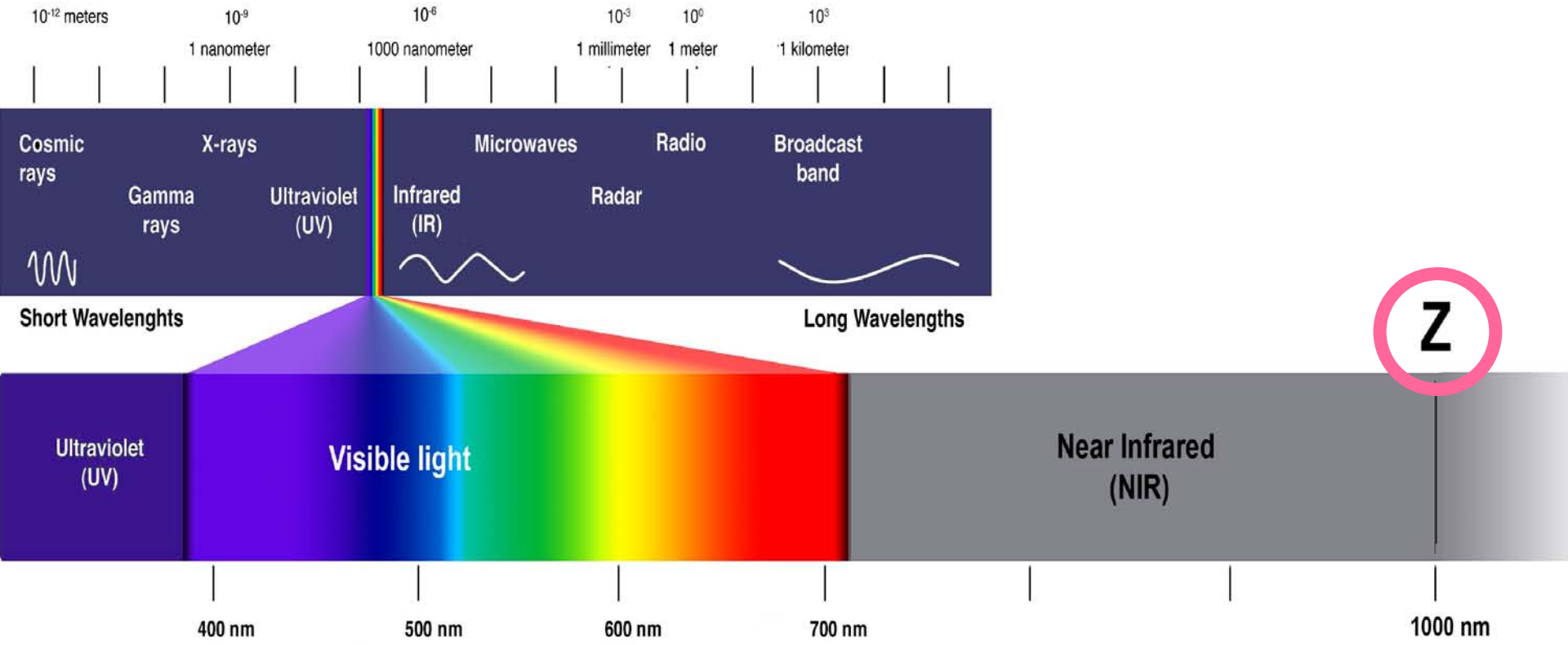
Introduction

The paper presents the results of the algorithm for production of **individualized QR codes** regarding to planning colors for **visual (V)** and **near infrared spectrum (NIR).**

The work promotes **INFRARED**ESIGN® technology through its theory which is based on the design of the graphics with the response in the near-infrared spectrum printed with standard process dyes.

What we see and what is hidden?



There is Extended
Infrared Reality!

Design and control of visual and infrared spectrum with **Infrared**design method!

What is **INFRARED**ESIGN method?

INFRAREDESIGN is invention unique in the world, patent awarded with over **60 prizes** from US (INPEX, Grand Prix) across Europe (London, Geneve, Moscow) to Asia.

Designing of double image in the same picture: one visible in daylight (400-700 nm) and other independent hidden image visible in near infrared light (Z1000 nm)

www.infraredesign.net

DIAMOND AWARD & **GOLD MEDAL**
The 10th British Invention Show & Awards,
British Innovation & Technology Show,
13-16 October 2010, London, UK

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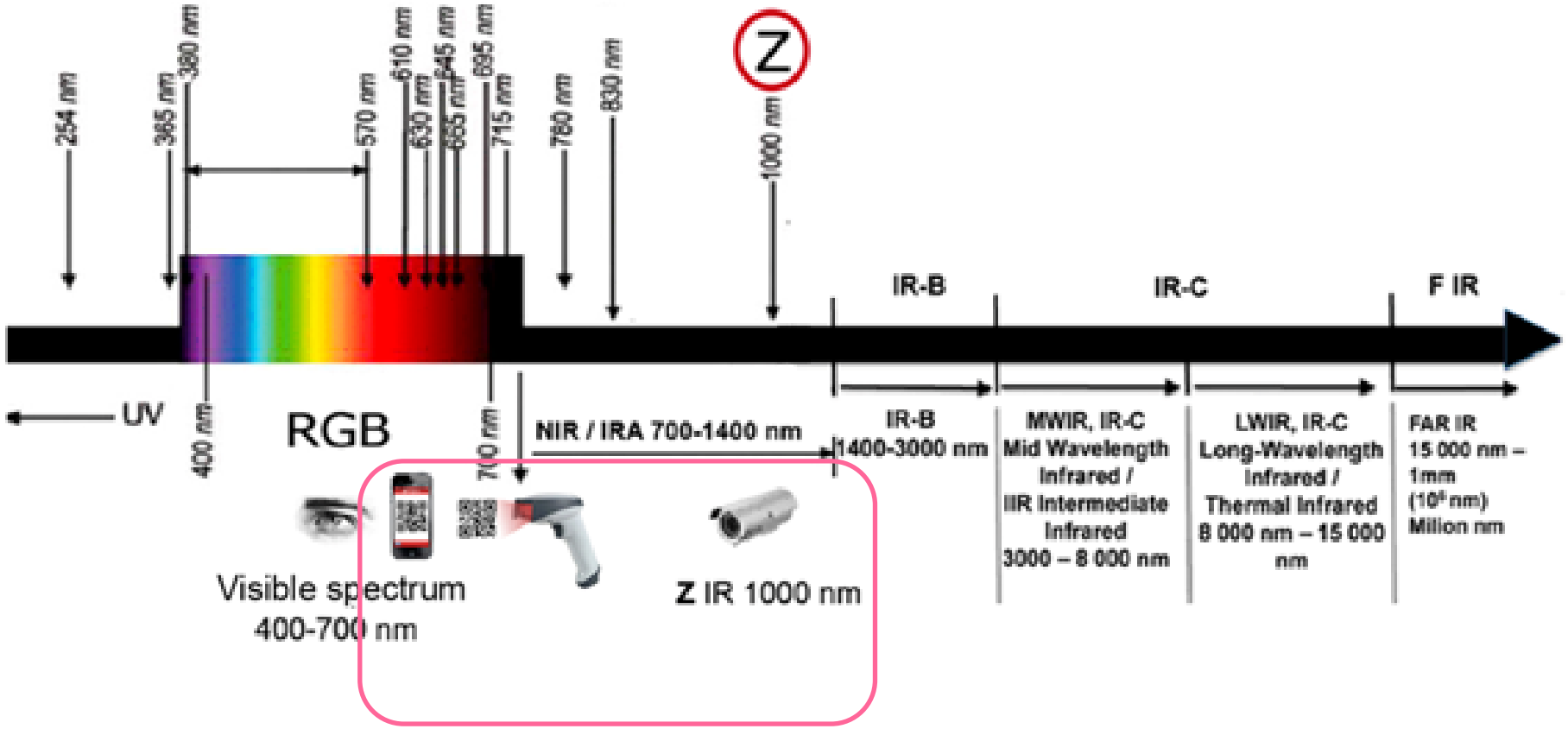
Original authorised QR codes which contain double-coded information for the visual and near infrared spectrum are designed.

The standards of coding and reading with the addition of new structures of hidden codes in the visual spectrum and NIR spectrum **are respected**;
they are printed on same location,
and are **readable by standard readers**.

In this paper, two experimental parts are presented:

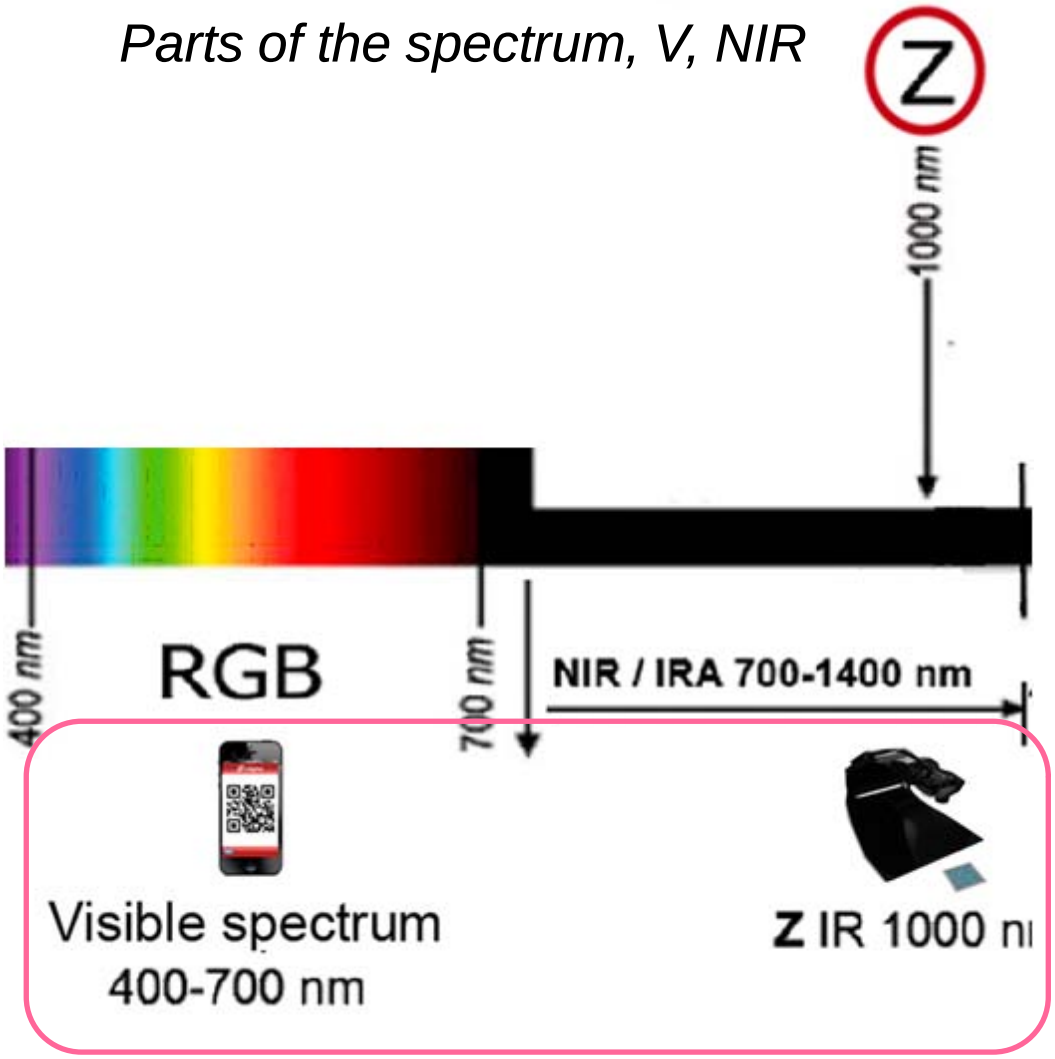
1. Freely designed Visual code derived as multicolour image.

2. a. Visual individualized code in whose **background** is the **infrared Z code** readable with associated software.
2.b. Conventional graphics which **hides the infrared Z code.**



Parts of the spectrum, V, NIR

Parts of the spectrum, V, NIR



Example shows a picture of Acropolis built into the original code so that the image merged with the structure of the code.

Hidden information: readable with app. i-nigma:
http://www.ic2014athensgreece.gr/

Coding and individualization of **visual and infrared data** depends on the position and structure of the encoded elements, level changes, and on the desired readability and printing technique.

The procedure of printing, testing and detection of optical and barcode readers is implemented on mobile devices and online via computer.

QR code Poseidon is designed so that the image is embedded in the background of the code.

Hidden information: readable with app. i-nigma: http://www.ic2014athensgreece.gr/

Example shows design of the code in terms of change of lines of code checkpoints. In the center of that code is embedded also the logo of IC conference

Hidden information: readable with app. i-nigma: http://www.ic2014athensgreece.gr/

Example shows redesign of the code by changing the color of certain parts of the code. We used te colors of IC conference.

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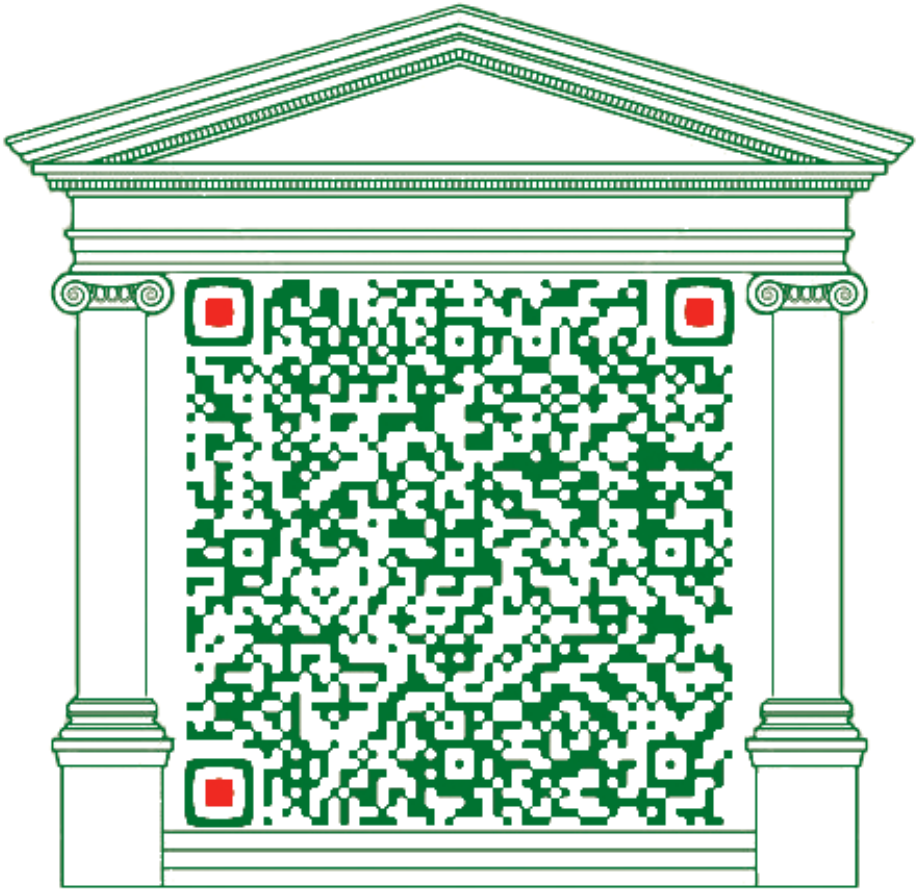

Hidden information: readable with app. i-nigma:

“The future of print, online and mobile media with use of individualised QR codes in V and NIR spectrum; Ivana Ziljak Stanimirovic, Anastasios E. Politis, Nikolina Stanic Loknar, Kristina Janko, Croatia, Greece”

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For the first time! Double QR code,
Infraredesign theory

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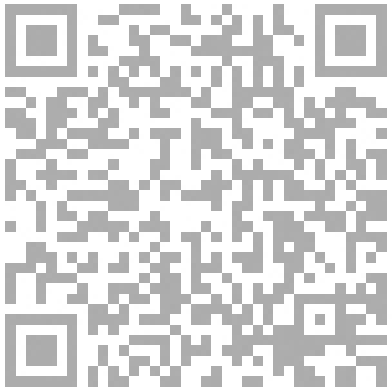
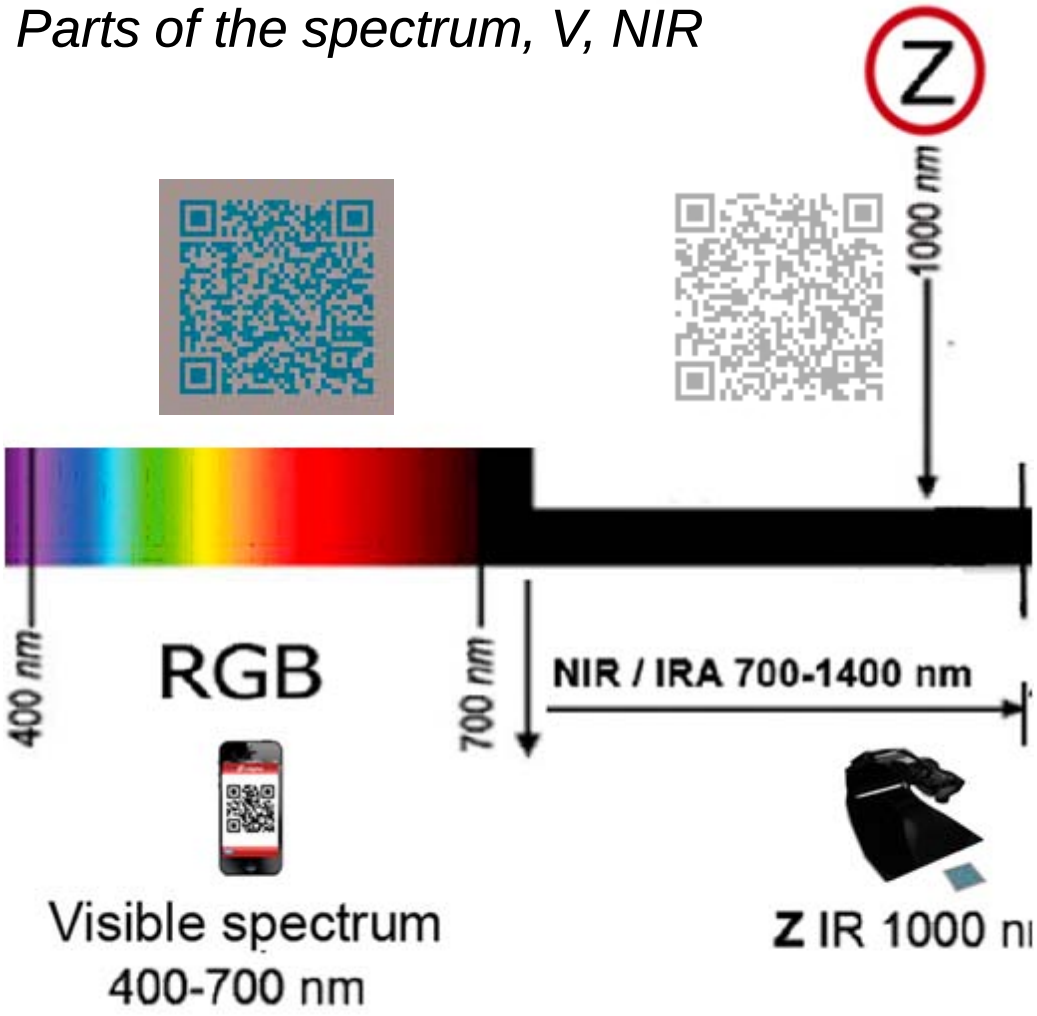
Double QR code

QR Code IC 2014
Visible spectrum



QR Code IC 2014
Infrared Z 1000 nm

Parts of the spectrum, V, NIR



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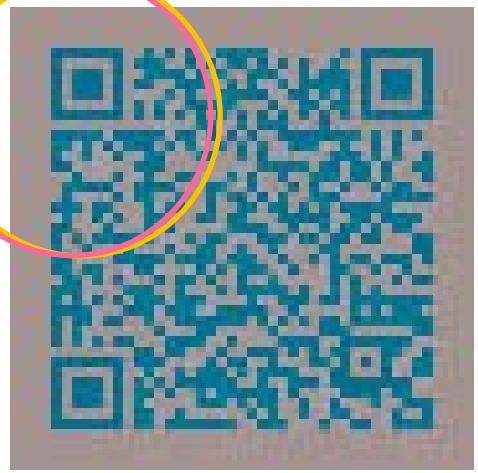
Double QR code

Stucture of two diferent codes



QR Code IC 2014
Visible spectrum

QR Code IC 2014
Infrared Z 1000 nm

Double QR code – visible spectrum

QR Code IC 2014
Visible spectrum

Text: “Ivana Ziljak Stanimirovic, Anastasios E. Politis, Nikolina Stanic Loknar, Kristina Janko, Croatia, Greece”

Double QR code – infrared spectrum

QR Code IC 2014
Infrared Z 1000 nm

Text: “THE FUTURE OF PRINT, ONLINE AND MOBILE MEDIA WITH USE OF INDIVIDUALISED QR CODES IN V AND NIR SPECTRUM”

The process of coding and individualization of visual and infrared data is discussed in a way which selects **visual** and **Z in the related informations**.

Design of infrared solutions is **based on the Z value** reading which have been successfully applied to the IRD graphics.

V. Žiljak, K. Pap, I. Žiljak-Stanimirović, J. Žiljak-Vujić, (2012.). "Managing dual color properties with the Z-parameter in the visual and NIR spectrum", *Infrared physics & technology*, Elsevier B.V., Volume 55, Issue 4, July 2012, pp. 326-336, ISSN: 1350-4495. (CC, SCI, SCI-Expanded)

This paper presents the products / QR codes which have been individualized and secured in the infrared spectrum.

Upon individual request, hidden infrared graphics can be embedded in packaging, documents, textile products.

Infrared message is visible at 1000 nm and it is designed with Z value.

Realised with standard printing techniques:

digital print, dry toner, inkjet,

offset,

silkprint,

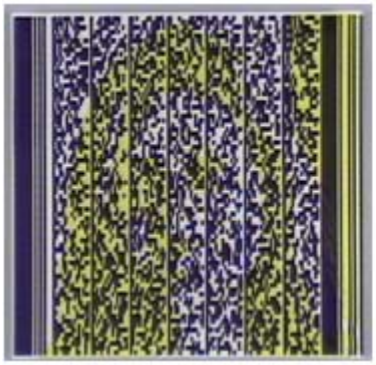
flekso print

Individualised QR code in flekso print

Visual (V)
400 – 700 nm)

Near Infrared
Z 1000nm

Flekso print



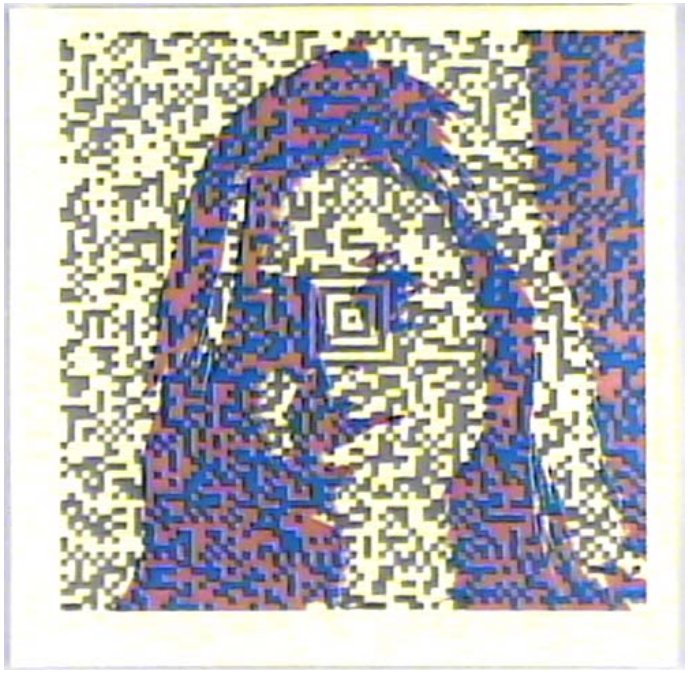
Visual (V)
400 – 700 nm

645 nm

780 nm

Near Infrared
Z 1000nm

Individualised QR code in flekso print



Visual (V)
400 – 700 nm)

Near Infrared
Z 1000nm

Flekso print

Visual (V)
400 – 700 nm

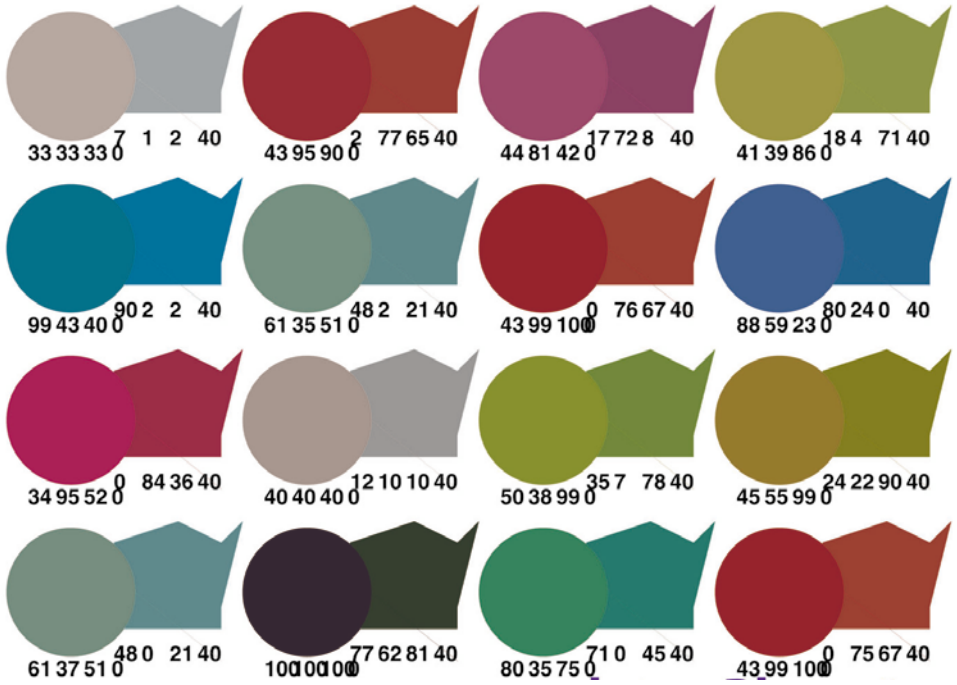
645 nm

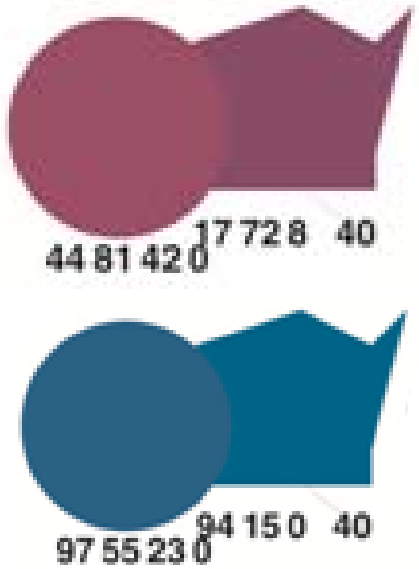
780 nm

Near Infrared
Z 1000nm

Individualised QR code in flekso print

INFRAREDESIGN, **Z** infrared, CMYK**IR** separation, **color twins**





Visual (V)
400 – 700 nm

Near Infrared
(Z 1000nm)
Z = 40

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PACKAGING | DOCUMENTS | TEXTILE | UNIFORMS

400 nm

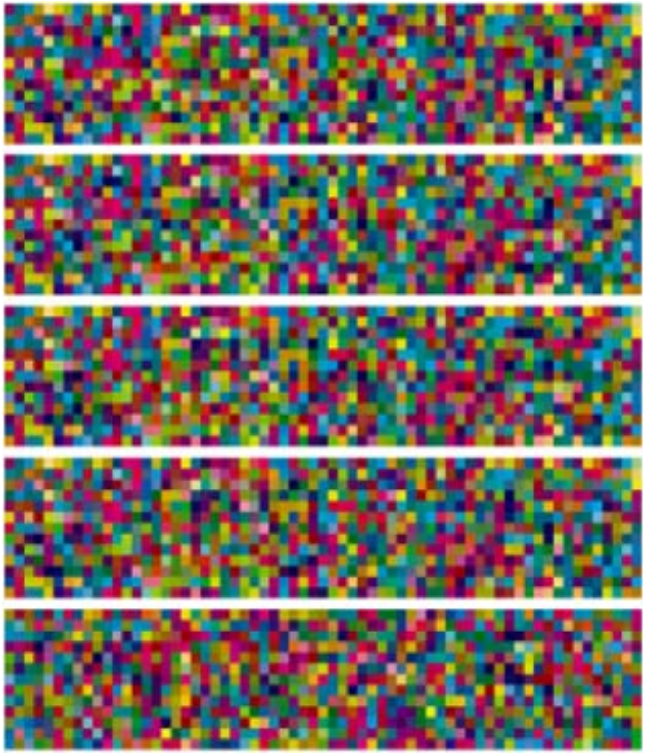
700 nm

VISUAL SPECTRUM

1000 nm
IR

NEAR INFRARED

Individualization, numbers, IRD text



Individualization is performed in a one single pass through the press, by defining color twins for each given color tone and printing technique.

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Individualization, IRD code, dots

Visual (V)
400 – 700 nm)

Near Infrared
Z 1000nm

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INFRAREDUNIFORM®

Visual

Near Infrared

INFRAREDDESIGN® – Textile Monochtomatic

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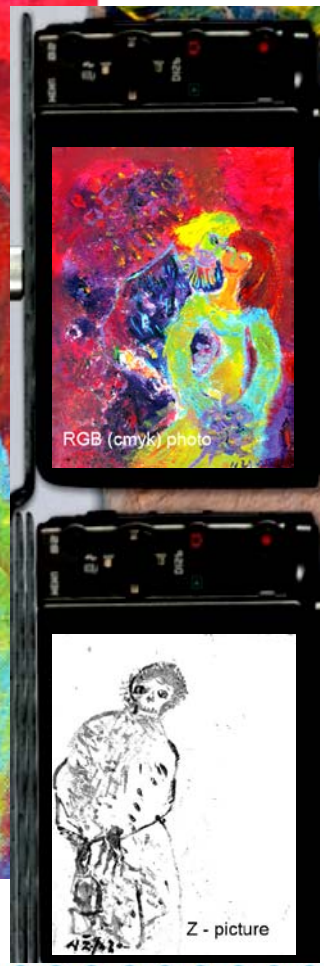
IRD ART

QR Code

Nada ZIljak

ZRGB CAMERA



RGB

Z !

Area of design, communications, prepress and printing extends to the near-infrared (NIR) region.

Conclusion 1

This research presents a **contribution to the protection** of printed products such as packaging, sales documentation and coding structures for special purposes in camouflage design through individualized codes in the near-infrared spectrum.

Original individualized and designed color codes with **controlled infrared response** enable **data protection** and **automated verification**.

Conclusion 2

The codes become **self-protected!**
This guarantees the originality of graphic products, enabling the **automatic passage through readers** and cash registers.

Dual codes for V and NIR spectrum can not be scanned or copied in order to product the printing form which would have the goal of falsification.

Code which is counterfeited by scanning or photocopying **will be rejected by readers as a forgery.**

Thank You :)

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