

THE LATEST DOCUMENT PERSONALIZATION TECHNOLOGIES AND THEIR DETECTION METHODS

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Abstract. *The protection of secure documents has been given great importance at all times. It doesn't even matter if it's a passport, a driver's license or an educational document, any secure document must be protected and made by a public authority. The use of forged documents costs the world billions of euros, as they can be used both to disguise one's true identity and to commit crimes. For the purpose of document protection, the modification of documents is constantly carried out, with the aim - to protect the documents of one's country as best as possible by using more innovative and high-quality methods of both production and personalization. The research will research and summarize the most innovative technologies used in the personalization process, as well as analyze the methods of technology identification.*

Keywords: *border, document, forgery, law, personalization.*

Introduction

Given the large flow of forged documents that are detained at the state border of the Republic of Latvia, it is important to receive timely information on innovative, not only security features used in secure documents, but also on personalization methods to detect and detain forged documents.

The aim of the research is to study and summarize the technologies used in the personalization process, as well as to analyze the methods of technology identification. Research period - 2022. Theoretical, descriptive and comparative research methods were used in the course of the research. In order to achieve the set goal of the research, the following research tasks have been set:

1. to study and summarize the technologies used in the personalization process;
2. analyzed technology detection techniques.

In order to be able to detect and detain a forged document at the state border, it is necessary to know the latest personalization methods, as well as to be able to recognize them.

Document personalization methods

The Law on the State Border Guard states that the functions of the border guard are to ensure the inviolability of the state border and to prevent



illegal migration (State Border Guard Law, 2020). In order to achieve this function, a number of tasks are mentioned, one of which is to carry out border control, to ensure and control compliance with the regime of national borders, national border zones, patrol zones, border surveillance zones, borders, border zones and border crossing points (Law on the State Border Guard, 2020). This task includes the verification of identity documents and documents of vehicles crossing the border, which is the most important stage in the border control process, because on the basis of the presented documents, the border guard decides whether the person has the right to enter, stay or leave the Republic of Latvia.

The Law on Identity Documents stipulates that an identity document is a document issued by a state administration authorized by law, which confirms the identity and legal status of its holder, and which, in accordance with the law, entitles its holder to cross the external border and is intended for travel abroad and is a travel document. According to this law, a passport and an identity card are considered as identity documents (Law on Identity Documents, 2012).

Article 4 of the Immigration Law. Article 2 states that a foreigner is entitled to enter and reside in the Republic of Latvia if he or she has a valid travel document. In turn, a valid travel document is valid if:

- (a) it is recognized in the Republic of Latvia,
- (b) it conforms to the prescribed model,
- (c) it contains the personal data and photographs of all aliens who use the document as a travel document. To apply for a residence permit, every foreigner needs their own travel document,
- (d) its period of validity exceeds the intended period of stay in the Republic of Latvia or in the territory of another Member State of the Schengen Agreement by at least three months,
- (e) it does not contain any unauthorized alterations, mechanical damage or spotting which makes it impossible to identify the holder of the document, to read the information contained in the document or to detect forgeries,
- (f) there shall be a space reserved for at least two border crossing marks on the pages intended for visas. This condition shall not apply if the international legal acts binding on the Republic of Latvia stipulate that border crossing marks may not be made (Immigration Law, 2002).

Every year, state border guard officers seize various types of forged documents at the state border and within the state. It should be noted that sometimes the counterfeits detected are of a very high quality, as secure documents are produced using equipment that is also available to counterfeiters. The number of criminal groups involved in the production of forged documents is also increasing, because depending on the quality of the forged document, it is considered a very lucrative business.

Counterfeit documents can be divided into four groups:

(a) complete forgery of a document: all components of the document have been reproduced in the same way as the original, using arbitrary materials;

(b) partial forgery of the document - some changes have been made to the content of the original document;

(c) "fantasy document" means a document of existing or non-existent States which is not recognized as valid for the purpose of establishing one's identity or traveling;

(d) stolen document form - the document is genuine but arbitrarily and illegally personalized (Indriksons, 2011).

In the case of partial forgeries, changes in the content of a document are most often related to personal data and a personal picture, the so-called personalization methods. Personalization methods are many and varied, such as inkjet or laser printing, which is quite simple and also available to counterfeiters. These are standard printer devices that are available for fairly cheap money. The simplest and, so to speak, the cheapest counterfeits are often made using this type of appliance. As already mentioned, each country makes every effort to protect its documents by constantly modifying them, using more innovative and high-quality production and personalization methods as much as possible.

We will also touch on some of the more innovative personalization methods. In the standard, most often - in polymer documents one method of personalization is used - laser engraving method. When modifying their national documents, so-called combined methods have also emerged, where a single document can contain up to three different personalization methods or variants. For example, the identity card of the Republic of Latvia for modification in 2019 or 2021 - polycarbonate material, with its own protection elements, safe dyes, personalization and production methods.



Fig.1 Identity card of the Republic of Latvia (Document sample library of the State Border Guard (DokAB))

This is the first document of the Republic of Latvia to integrate a color image - the personalization method "LASINK". Personal data in this document is incorporated by laser engraving method, certificate number with tactile laser engraving.

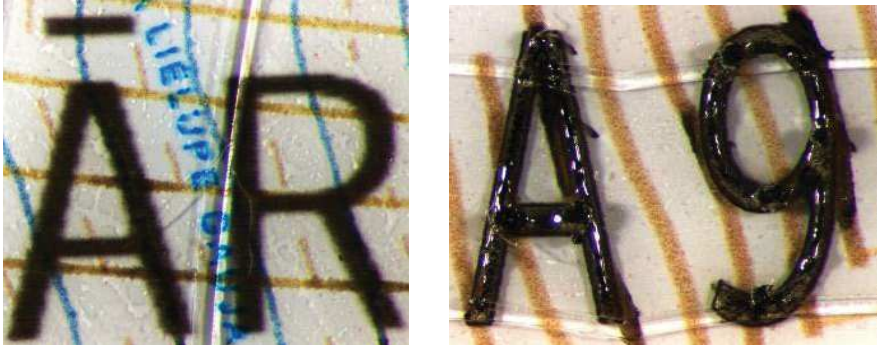


Fig.2 Laser engraving and tactile laser engraving
(Document sample library of the State Border Guard (DokAB))

Laser engraving is always black and white, as the data is laser embedded in one of the polycarbonate layers. Tactile The peculiarity of laser engraving is that it differs from laser engraving - letters or numbers can be touched and explored in the side light, as a relief effect is created. Laser engraving is also used on the polycarbonate document to create a color image, but on a pre-printed line matrix (Unpublished materials of the State Border Guard).



Fig.3 Black and white picture polycarbonate document
(Unpublished materials of the State Border Guard.)

LASINK technology is a unique process for printing laser inks on polycarbonate. LASINK not only improves the security of your identity document, but also facilitates the automated verification of its authenticity, thus speeding up the verification of passports at borders and giving users secure and unhindered access to online services (Source: Idemia, 2022).



Fig.4 Zoomed image in "LASINK" technology
(Unpublished materials of the State Border Guard)

The irreversible personalization of color images inside polycarbonate credential substrates is a challenge. With standard printing techniques, the color photo needs to be protected by an overlay or a varnish, resulting in compromised document integrity as well as loss of tactile features. Printing the color photo in one of the polycarbonate layers before the lamination step during manufacturing is a secure solution. However, it makes the issuance process inflexible. The now secure and flexible technique is the use of a laser that engraves a photo with gray tones into the polycarbonate. To be this limits personalization to black and white pictures (Idemia, 2022).

With LASINK, the color portrait of the document's holder is directly engraved into the polycarbonate structure by a laser during the personalization stage. LASINK color photos have a unique linear pattern that acts as a signature to authenticate the document. Its recognizable design cannot be imitated with any digital printing technology or forged as the picture is deep in the body and not at the surface of the document. The ID document is impossible to delaminate. The personalization technique is kept secret and prevents the use of stolen blank documents. LASINK gives flexibility to governments: it can either be used in central or decentralized personalization solutions. LASINK is robust and offers a ten-year lifespan (Idemia, 2022).

The next, no less secure and innovative method, also used in polymer documents, to integrate color imaging is "polymer-adapted inkjet printing". It's no secret that inkjet printing (a standard inkjet printer) is used in paper documents, but now it is possible to use the inkjet method (special - polymer-

adapted inkjet printing) in polymer documents to reproduce a color photograph.

When researching 'inkjet printing' and 'polymer-adapted inkjet printing' to distinguish between them, the technical means by which border checks are carried out play an important role. Technical means of border control, these are the means used for the inspection of persons, land vehicles, railway transport, aircraft, as well as vessels and cargo and other property carried by them at border crossing points (Regulations on the Technical Means Necessary for Border Inspection and Border Surveillance, No. 675). With first-line equipment (standard magnification available) - both inkjet and polymer - adapted inkjet printing can be identified by standard features - chaotically scattered dots.



Fig.5 First line equipment (Source: Regulaforensics, 2022)

The standard magnification - both inkjet and polymer-adapted inkjet - can be recognized by standard features - chaotically scattered dots.

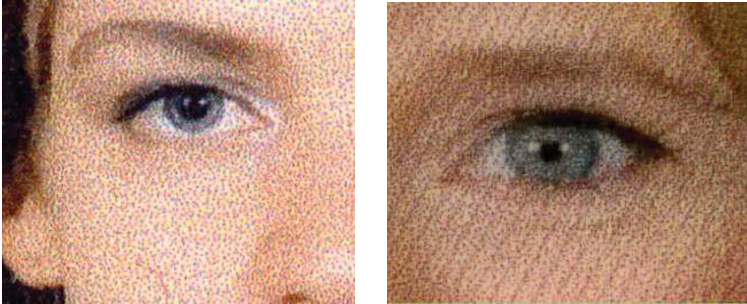


Fig.6 Research of personalization methods with first line equipment (Source: Regulaforensics, 2022)

The second line of document inspection uses in-depth inspection equipment, which is used for in-depth inspection of personal and vehicle documents presented at the border crossing point, as well as other legal documents, in order to confirm and visualize the signs of forgery detected in the primary inspection.



Fig.7 Document check second line equipment
(Source: Regulaforensics, 2022)

When using second-line equipment, ideally a microscope, the difference between inkjet and polymer-adapted inkjet printing is obvious, which is particularly evident in the structure and visual appearance of the ink dots.



Fig.8 Polymer-adapted inkjet printing on polymer documents
(Source: DPR, 2022)

The photograph is printed on an internal layer using an inkjet printing method. The ink consists of polycarbonate particles. After the fusion of the different layers, the polycarbonate ink will diffuse through the different layers. Under magnification the individual ink droplets look elongated.



Fig.9 Inkjet printing on paper documents
(Source: DPR, 2022)

During the examination of border control documents, in order to be absolutely certain that the appropriate personalization method has been used in the presented document - sometimes the technical equipment of the primary documents is not sufficient. Depending on the quality of the forged document, how professionally forged it is, additional in-depth research equipment is often required.

Conclusions and suggestions

Different types of secure documents have been forged at all times, and this is inevitable, so it is very important for every country to think about document protection, constantly modifying it, using more and more innovative personalization and production methods, and using newer and more sophisticated security features. Innovative personalization techniques are quite secure because they are almost impossible to reproduce. Most often, counterfeiters use inappropriate personalization methods when trying to imitate color pictures in polymer documents. Using technical equipment, their theoretical knowledge and practical experience in document research, as well as following the trends of forged documents, which are detained at the state border of the Republic of Latvia, border guards perform their direct duties and prevent forged documents from entering the country.

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