

The latest Security Techniques Used in Passport Design

Assoc. Prof. Dr. Mostafa Mahmoud Mohamed Khalil

Associate Professor at Printing, Publishing & Packaging Dep.

Printing, Publishing & Packaging Dep. Faculty of Applied Arts, Egypt - Helwan

Univeristy

mm_3m@yahoo.com

Research Summary:

Passports are critical travel documents, For that nations secured the design of the passport to reducing avoidable crimes facilitated by international criminals. by using the new feature passport design's elements increased Security enhancement to be trusted in all international airports. from here came the research problem that spot in those points: Not to keep pace with the Egyptian passport's securing elements for innovative new technologies and the need to evolve to face the criminal operations aimed at forging the contents of passports. and the research methodology is the descriptive approach, which is based on describing the innovative techniques used in passport design to increase its security degree. the research aims to: keep abreast of the global innovative technologies in passport designs to raise its security degree with the latest technology, which not used by Egyptian's passport design to be a guide for passport authority in future developments, and in order to achieve the research's aims; the research was divided into three main axes (1- Passport Main Data Page, 2- Passport Visa Pages, 3- Passport Cover).

The research results came to confirm using all this items to get a highest secure's passport: intaglio printing method to print Micro printing and nano text, kinogram design lamination layer, Complex design for visa cross-page, laser burning technology used to burn numbers as a perforations with different shapes, Security threads, Special inks like IR reflective or absorbent, Edge design with UV characters become visible on the passport given a view from the opposite side by UV Light, Using the sewing fibers consist of three colors fluoresces by UV light, Ease passport detection by RAFID embed chip, high technology of laser engraving for engraved data and pictures on polycarbonate, Multi layer data page gives high resistant construction and highest resistance against thermal stress.

The research recommends that the Egyptian Ministry of the Interior implement all the research points include techniques and raw materials to secure the Egyptian passport against counterfeiting whatever the cost, in order to maintain national security.

Key words: passports, e passports, passport security features, passport data page, visa page, Security Threads Kinogram.

ملخص البحث:

جواز السفر هو وثيقة سفر حاسمة تسعى الدول دائماً لتأمين تصميم جواز السفر للحد من الجرائم التي يمكن تجنبها والتي يسهل ارتكابها من قبل المجرمين الدوليين. ومن خلال استخدام عناصر تصميم جوازات السفر الحديثة تزداد عناصر الأمان التي يمكن الوثوق بها في جميع المطارات الدولية. من هنا جاءت مشكلة البحث التي تكمن في تلك النقاط: عدم مواكبة عناصر تأمين جواز السفر المصري للتكنولوجيات الحديثة المبتكرة والحاجة إلى تطوير تصميم جواز السفر المصري لمواجهة العمليات الإجرامية التي تهدف إلى تزوير محتوياته. وينتهي البحث المنهج الوصفي، الذي يستند إلى

وصف التقنيات المبتكرة المستخدمة في تصميم جوازات السفر العالمية لزيادة درجة تأمينها. ويهدف البحث إلى: مواكبة التقنيات المبتكرة العالمية في تصاميم جوازات السفر لرفع درجة تأمينها بأحدث التقنيات، والتي لم يستخدمها تصميم جواز السفر المصري حتى تاريخ البحث لتكون دليلاً لإدارة الجوازات المصرية في التطورات المستقبلية، ومن أجل تحقيق البحث أهدافه؛ تم تقسيم البحث إلى ثلاثة محاور رئيسية (1- صفحة بيانات جواز السفر الرئيسية ، 2- صفحات تأشيرة جواز السفر ، 3- غلاف جواز السفر).

وجاءت نتائج البحث لتأكيد استخدام كل هذه العناصر للحصول على أعلى تأمين لجواز السفر عن طريق استخدام كل من: طباعة الـ intaglio لطبع خطوط الجليوش والنصوص الدقيقة، طبقة تصفيح الـ kinegram، التصميم المعقد لأرضيات صفحات التأشير، تقنية حرق الليزر المستخدمة لحرق الأرقام على هيئة ثقوب بأشكال مختلفة، خيوط الأمان، استخدام أحبار الـ IR العاكسة والماصة، تصميم الحواف بأحرف مطبوعة بأحبار UV لتصبح مرئية بواسطة الأشعة فوق البنفسجية، حياكة الصفحات باستخدام ألياف تتكون من ثلاثة ألوان تتفلورتحت ضوء الأشعة فوق البنفسجية، سهولة كشف معلومات جواز السفر من خلال تضمين رقاقة الـ RFID، استخدام تقنية النقش بالليزر للبيانات والصور على صفحة البيانات متعدد الطبقات، استخدام البولي كربونات الذي يعطي طبقة مقاومة عالية تتحمل الإجهاد الحراري. يوصي البحث بأن تقوم وزارة الداخلية المصرية بتنفيذ جميع نقاط نتائج البحث بما تشمله من تقنيات ومواد خام لتأمين جواز السفر المصري ضد التزوير مهما كانت التكلفة، وذلك للحفاظ على الأمن القومي المصري.

الكلمات المفتاحية: جوازات السفر ، جوازات السفر الإلكترونية ، ميزات أمن جواز السفر ، صفحة بيانات جوازات السفر ، صفحة التأشير ، برنامج أمن المواضيع.

Introduction:

Passports are critical travel documents that facilitate voluntary movement. Passports were introduced to regulate global movement as every government budgets for its citizens' wellbeing, whereby the immigration department must account for people who enter or leave a country to realize this goal. Equally, nations implemented the use of passport towards reducing avoidable crimes facilitated by international criminals. The acquisition of the travel document limits their entry to fraudulent target nations, a factor that controls the occurrence of the mishaps linked to terrorism. Despite the policies and mechanisms adopted by different countries to safeguard nations' welfare, passport fraudsters devise approaches to outsmart the government and help criminals accomplish their evil intentions. Learning about the latest security measures and techniques for passport informs people that the government remains adamant about safeguarding citizens by ensuring that counterfeits passports are eliminated and the culprits punished for committing a crime.

Employing Technologies That Are Difficult to Copy

Passport fraud is a major concern all over the world since people use the document to migrate to other countries for various reasons such as finding jobs or for criminal activities. Passport issuing departments should employ technologies that are difficult to replicate. Security is critical when issuing passports because the techniques of tampering with passports are broad and diverse. Forgery of passports exists and occurs regularly following the mastery counterfeit techniques and the availability of advanced technology availed by dishonest government leaders and fraudsters. Passports are delicate documents whereby the owner should handle it with care and safeguard it from unknown people. When impostors have

access to a lost passport, they use it to forge an identity and sell the copy using illegal channels such as the black market concept. Consequently, new technologies that secure passport are meant to prevent forgery and identity theft.

Research Problem:

Lack of innovative protection elements against counterfeiting and forgery for Egyptian passport.

Research Methodology:

The research methodology is the descriptive approach, which is based on describing the innovative techniques used in passport design to increase its security degree.

Research Aims:

Keep abreast of the global innovative technologies in passport designs to raise its security degree with the latest technology, which not used by Egyptian's passport design to be a guide for passport authority in future developments, and in order to achieve the research's aims; The research was divided into three main axes As follows:

- (A) **The first axis:** Passport Main Data Page
- (B) **The second axis:** Passport Visa Pages
- (C) **The Third axis:** Passport Cover

(A) The first axis: Passport Main Data Page

(A-1) Incorporating Multiple Security Features in the Main Data Page



Picture No. (1) Passport main page Multiple Security Features layers

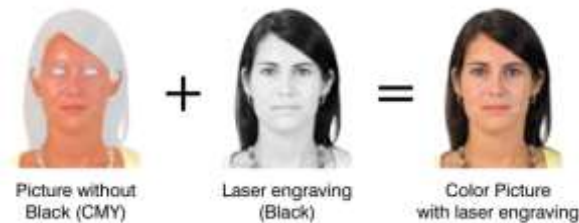
Falsification of identity remains a recurring concern linked to passport fraud. Criminals use stolen and lost passports create new documentation by forging identity to conceal the image of the buyer especially when the new owner requires the travel document to migrate to another location. [4], control measures are enacted in airports towards combating passport forgery. For instance, current passports have a chip that has biometrics details, which are unique to every individual. If a person issues a stolen passport at the airport, the biometric

system will confirm the theft because the particulars indicated from the retrieved data will prove the identity of the real owner. Eventually, the issuer will be caught and detained for further questioning. In such a case, the confirmation of identification is vital for security check purposes when processing to board an aeroplane. Some of the most popular practices that facilitate various feature securities include in additional lamination to alter the portrait a bit, interchanging biographical information pages, and modifying the history of travels before crossing a border [4]. Substitution and lamination of the document involve tampering with a valid document to change the portrait undetected. Fraudsters usually place a fragile laminate film over the image to distort it, cut, and remove the image. Later, they carefully insert a different picture issued by the buyer. Overall, in mitigating such problems, the contemporary passport has embossed features, advanced secondary images, security kinegram design lamination layer, and complex printing technique. In case of any tampering, immigration officers will know following their competence in identifying forged passports.



Picture No. (2) Switzerland, Passport with kinegram lamination layer from Kurz

securing the photo by using MB EMBEDDED PICTURE new technology that combines the black laser engraved color separation together with CMY separation color inkjet to achieve a high complicated secure photo against any forgery manipulation [10].



Picture No. (3) MB EMBEDDED PICTURE from Mühlbauer

(A-2) Chemical Secure Printing Processes

Generally, the counterfeiters use two main ways to remove an endorsement from a passport. They either scratch it off with a scalpel or find the correct solvent to dissolve the approval. Finding the right chemical has proved to be difficult for counterfeiters. Similarly, pigmented indelible inks cannot easily be removed from the substrate. If fraudsters attempt to recreate the passport pages, they will fail since their ink of use will damage the printing paper or fiber because of the chemical reaction, which leaves a visible mark as a forgery trail [6]. The use of chemical safe printing approaches is necessary to enhance security as the damages can be spotted.

(A-3) Materials, and Technology

The printing of passports is now a more complex design that combines various layers of printing features laminated together, while the stitching also is upgraded to make it near impossible to emulate [11]. Watermarks are a crucial security feature against fraudulent travelling history. Most of the time criminals remove and hide border stamps to disguise the duration they have been in a particular country. However, by eliminating the seals, they damage the watermarks as well as the secure printing on the passport paper making it evident that the passport was stolen and tampered with by the passport issuer [3].



Picture No. (4) Singapore, Passport with Multiple Security Features

The use of polycarbonate replaced the traditional material used for making passport to safeguard illegal replication of the document by criminals. The concept is known as a one block concept where all security and identification data are integrated to protect each other from fraudulent attempts [12]. For instance, within these cards, the passport photo is locked in-between secure artwork and printed features, such as positive or negative embossing [12]. Any attempt to change the picture destroys a portion of the printed elements while attempting to access the layers of the document will leave visible evidence of tampering. Polycarbonate is extremely durable, in heat or through intensive usage and is the most reliable and secure material for identification purposes, which explains why the immigration recommends its use for making passports [12].

(B) The second axis: Passport Visa Pages

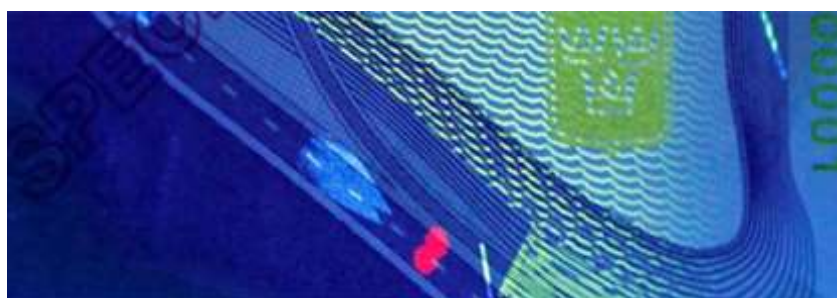
Passport visa pages and numbers are security measures embedded in the document to reduce false cases. Every country has some pages that they require in a passport for travelling purposes. Passport holders must ensure that each page is intact or else it could alarm the immigration officers assessing the validity of a passport. While passports are, and always will be, a symbol of national pride and sovereignty, it is imperative that people understand that their security relies on their make. Common threats such as forgery, alterations and counterfeiting are overcome by modern security features in passports making them either easier to detect or near impossible to replicate. Fraudsters develop more sophisticated methods every day, so it's vital that passport security can evolve and progress to stay one step ahead of their plans and ideas.

(B-1) Intaglio Printing, Anti Copying, and High-Security Papers

Picture No. (5) Intaglio Printing

Passports render criminals a lot of leverage especially if they can run away to another country incognito. The fact that people have managed to use this procedure illustrates the rate of deception and scam used by people to realize their needs and wants at the expense of vulnerable persons. The government updated its security to protect citizens from identity fraudsters by using Intaglio to secure passports [7]. When applying the concept of Intaglio, the image is scratched, cut or etched into a printing surface or plate to reduce instances of duplication because of the presence of the metallic plate [7].

Also the complex design for fine patterns printed with four colors and UV 365 in two colors offset inks, and IR inks are used as Anti copying security elements in passports pages as shown in picture no. (6).

Picture No. (6) Anti copying elements in [Swedish passport](#) under UV light**(B-2) Visa Pages and Design**

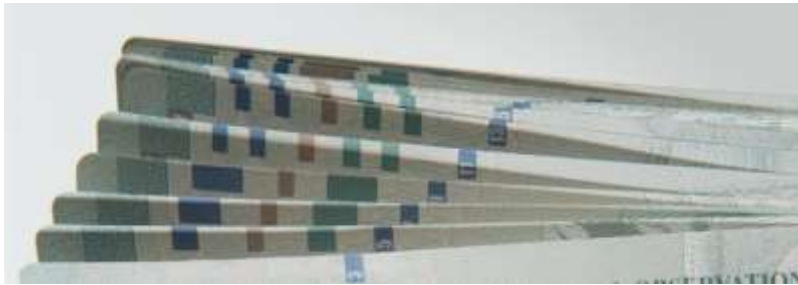
Picture No. (7) Complex Design for Visa Pages

Security officers follow stringent protocols when checking passengers in and out of airports to protect people from unnecessary risks. In such a case, departments that facilitate visa application have over time become extra cautious on their approaches to administering the visa because some fraudsters provide fake passports and receive travel permits. The officers ensure that passports are genuine by checking all security features embedded in the document. Furthermore, some countries initiate travel bans on states that indicate cases of passport fraud and blames the respective governments for failing to address the problem. Such Bans enable the affected nations to restructure their immigration system to accommodate honest staff. In

general security techniques on passports remain a serious issue over the years and by so doing a lot of harm has been prevented especially for citizens. Fear of identity theft has been real especially when avoidable crimes happen facilitated by identity theft cases. Eventually, countries should continue to increase security measures on passports to make towards controlling fraud and passport related identity theft.

3-3 Page Numbering

Passport pages are numbered consecutively throughout the booklet. The approach is a distinct way of providing reassurance that pages stay intact to reveal the consistency of the owner's traveling history. The numbers exist on both areas and remain visible under the UV light [9]. The passport manufacturers roll rubber stamp containing the ink image of the numerals to achieve the offset print details. The materials used for the process include bi-focusing lines and a see-through printing machine to limit human error. Eventually, the protection embedded in the passport pages are irreplaceable.



Picture No. (8) Cross Page Numbering

laser burning technology used to burn numbers as a perforations with different holes shapes for example triangles, circles, squares and stars [5].



Picture No. (9) passport number including circles squares and stars

3-4 See Through Printing Approach for High-Security Printing

The see-through model illustrates the creation of security design that comprising of two parts. Passport makers print the first image on the front of the document and the second illustration on the reverse page. The visibility of the images on either side is noticeable under UV light transition. Therefore, the concept explains why immigration officers place passports under UV light in the process of serving customers. The printing of an image on both sides of a passport page without flipping the pages ensures the security of the passport and limits cases of replication. Furthermore, the high-security printing machine is designed for immigration departments to reduce the likelihood of counterfeiters accessing the device and use it to commit crimes. Eventually, the outcome is a blurry image that fails to meet the immigration requirements of valid passports.

3-5 Special Security Printing Inks and Layers

Security printing inks and layers aim at complicating the passport manufacturing process that has been invaded by scammers for several years. Therefore, the pages are printed on security paper that bears no optical brightener. Special security printing inks used include IR reflective or absorbent but appear the same in white light [1]. Government licenced passport makers attach fibres in the document during the manufacturing process, which remain invisible to the human eye noticeable under UV lighting. In doing so, it complicates the forgery process for counterfeiters to replicate the material.

3-6 Watermarks



Picture No. (10) Watermarks

A watermark refers to a design formed in a paper using a tonal gradation that is visible when reflected in the light [8]. Credible passport manufacturers use a different watermark for the data and the visa pages of the document to impede imitators who may try to replace any information. The multi-toned cylinder mould watermarks are utilised for visa pages [8]. The manufacturers position the watermark at the centre of the page area to ensure optimum visibility [8]. Passport manufacturers also implant similar bright watermark on all passport pages to differentiate the travel documents from fake passports.

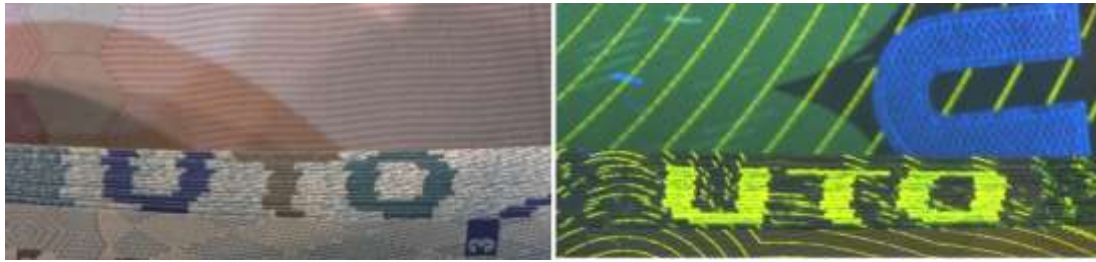
3-7 Embedded Security Threads in Visa Pages



Picture No. (11) Security Threads

Security threads remain highly effective, of great value, and long-lasting security features. Vastly recognized by the public, security threads are complex to develop to ensure protection against fabricating [9]. During passport making, security threads are created to customer specifications and fully embedded into the visa pages or appear evenly as window threads on its surface. Therefore, following the difficulty in producing the threads, it becomes hard for counterfeiters to create a fake document.

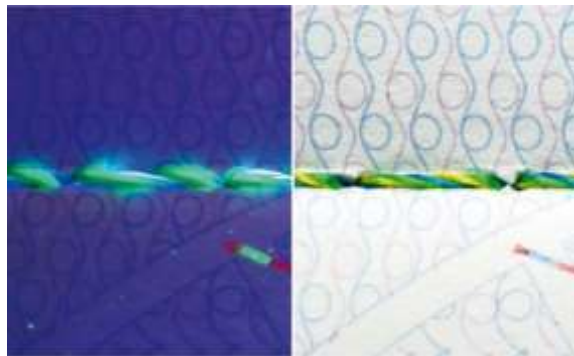
3-8 Edge Design in Visa Pages



Picture No. (12) UV. Edge Design

Edge design is a prospect incorporated on travel documents to the fight against counterfeiting of visa pages. Manufacturers print different edges for each page such that when the pages are spread under UV light the words are a replicate of the image on the offset print. UV characters become visible on the passport given a view from the opposite side. Each page has floating page numbers, in both visible and UV printing. Therefore, counterfeiters experience challenges trying to reproduce the same passport without missing the required steps as such fostering security.

3-9 Passport Sewing and Stitching



Picture No. (13) Passport Sewing

The process of manufacturing a passport also includes stitch-sewing. The passport makers maintain consistency of the stitches by using an automated device that fuses three different fiber-like threads on every page. The sewing fibers consist of three colors fluoresces by UV light. The consistency of the sewing machine ensures that the threads are pulled and twisted similarly throughout the process in all holes and maintain the same length for each stitch. Moreover, each passport has two significant tacks to hold the pages together [2]. Finally, the seams are sealed using an adhesive or spine tape for the stitches to last. Lastly, the threads constitute of detached strands, if interfered with, they separate easily and fast. Eventually, the approach assures passport security and safety.

(C) The Third axis: Passport Cover**Picture No. (14) Passport Cover**

Latex is the preferred material for making passport covers because of its saturated component combined with adhesives that hold the end pages firmly and permanently. The latex component of the material gives the cover page a sturdy but smooth texture. Eventually, it protects the inner pages from damage.

(C-1) Embed RFID Chip in Cover**Picture No. (15) Embed RFID Chip**

At least most, if not all, developed countries embrace the idea of RFID chips rooted on passport cover pages. Security and immigration officers will require a digital scanner used it at close range to identify the contents of the passport. The chip in the passport contains the sensitive personal information found on the photo page of the passport, including the portrait [14]. The chip can only be used for passport related issues only. The RFID secured passports will comprise the owner's confidential information and unique to every passport holder. If someone tries to steal the passport and alter the personal information found on the page, the immigration official who scans the chip will notice that the information does not match and therefore can order for the arrest of the fraudster. RFID chips are embedded on items such a hotel room keys, company ID cards, and student IDs. The microchips are also found in credit cards and contain sensitive information similar to the chip in a passport. Therefore, in developing the chips, the security of passports is enhanced such that when scanned, the information retrieved must match the bearer. As a result, it fosters passport security.

The process of manufacturing and securing passports is artistic. Passport manufacturers need the government recommended materials and resources to meet the demands of a credible passport. Unfortunately, passport scammers acquire the same materials to forge passports and

sell the counterfeits illegally to criminals. Despite the counterfeiters' techniques to manufacture passports that are similar to the credible ones, they lack the machinery and know-how provided to government workers. Features such as watermarks, viable RFID chips, chemical sensitizers, and fibres are unattainable to the scammers. Therefore, their inability to access these materials impede their ability to manufacture credible passports that meet immigration requirements. Overall, the advancement in technology has improved passport security, which has aided in limiting the movement of criminals from the international space to disrupt peace in other countries. The government should maintain the effort and continue advancing their artistry by imparting knowledge about ways of detecting fake passport not only amongst the immigration workers but also the passport holders.

Results:

The new feature passport design elements increased Security enhancement to be trust in all international airports as following:

1. using intaglio printing method to print Micro printing and nano text, make replication still more difficult.
2. Using security kinegram design lamination layer protect the passport data against Fraud
3. Complex design for visa cross-page printed on security paper with four rainbow colours design make difficult to remove a single page or Forging the page itself.
4. Using laser burning technology used to burn numbers as a perforations with different holes shapes increases the complexity of the design and raise the degree of security against counterfeiting.
5. Using Security threads remain highly effective, of great value, and long-lasting security features becomes hard for counterfeiters to create a fake document.
6. Using Special inks like IR reflective or absorbent look identical in white light add more security to the printed design.
7. Edge design is a prospect incorporated on travel documents to the fight against counterfeiting of visa pages, UV characters become visible on the passport given a view from the opposite side by UV Light.
8. Using the sewing fibers consist of three colors fluoresces by UV light give add value the passport finishing technique
9. Ease passport detection by Automated or machine assisted verification at airports through biometric data on RAFID embed chip .
10. Using high technology of laser engraving for engraved data and pictures give the passport design High Security personalization.
11. Multi layer data page gives add value to Long life span of personalized document.
12. using Multi layers combined with polycarbonate in passport data page gives high resistant construction and highest resistance against thermal stress.

Recommendations:

- 1- The research recommends that the Egyptian Ministry of the Interior implement all the research points include techniques and raw materials to secure the Egyptian passport against counterfeiting.
- 2- The research recommends securing the Egyptian passport with the latest technologies, whatever the cost, in order to maintain national security against the Innovative counterfeiting and forgery processes.

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