Digital Watermarking on Bank Note

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Abstract: Watermarks are the marks of authentication or the proof of ownership. In this paper, we are trying through light on the digital watermarking concepts and their techniques .Elaborating with one of the most commonly observed application of digital watermarking i.e "Banknotes". This is the best way to get ride of the illegal currency notes spread all over the world. As the printing company involves the digital platform so the challenging operation is the security of the documents printed so the is doesn't increase or multiply in number but unwanted sources. Watermarking done on banknotes are of both visible and invisible types. We as common people can detect and check only the visible watermarking.

Keywords: Watermark, Watermark Fluid, Dandy Roll Process, Cylinder Roll Process, EURion constellation

I. INTRODUCTION

Today the use of growing internet and displaying of multimedia contents on the internet has become widespread activity. We all know that techniques based on the combination of multimedia and internet are well renounced all over the world. Youtube , Facebook, Torrents such video, audio, image, documents are the part and parcel of common man specially popular among young generation of today. For this it becomes very necessary to protect the rights of authors. As it is based on digital media so the need of digital protection mechanism is necessary and in-evitable. More information is transmitted in a digital format more the danger to data. There are many types of digital information and data.

1) Digital images
2) Digital audios
3) Digital videos

A watermark [1] is a pattern of bits inserted into a digital image, audio or video file that identifies file's copyright information (authors, rights, etc).

A watermark

is a recognizable image or pattern in paper that appears as various shades of lightness/darkness when viewed by transmitted light (a atop background is viewed when we put in reflected light), caused by thickness or density variations in the paper. . Watermarks can cover an entire page or can be smaller and placed on a specific area of a page

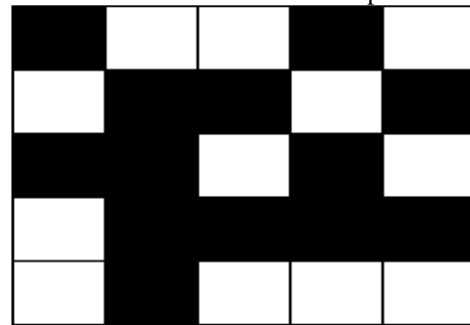The popular techniques used for protection are as:

1) Steganography
2) Digital Signature
3) Fingerprinting
4) Cryptography
5) Digital Watermarking

Explanation of watermark with the help of this image

The matrix form of the above image or can say the watermark of the above image in the form of 0,1
Assuming here that the darker part= 1, and lighter one= 0

W{ 1,0,0,1,0
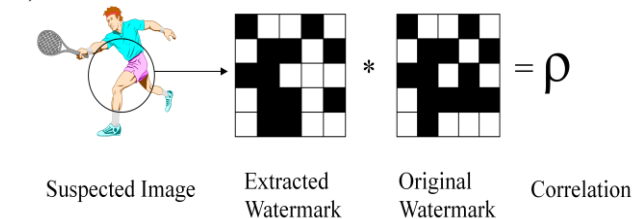0,1,1,0,1
1,1,0,1,0
0,1,1,1,1
0,1,0,0,0}

II. REQUIREMENTS OF DIGITAL WATERMARKING [2,3]

a) Watermark Embedding:

The process of embedding data into a multimedia elements such as images, audios, video file for the purpose of authentication [4]. This embedded data can later be entered from, or detected in, the multimedia for security purposes

Watermark   Original Image   Watermarked image
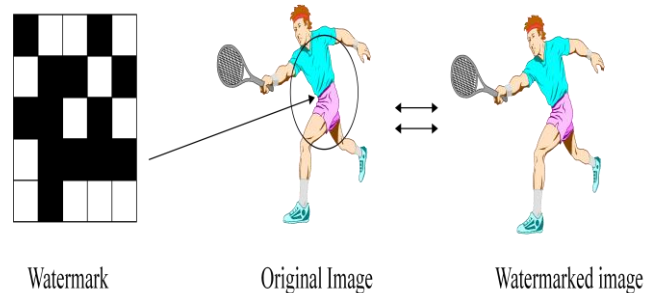
b) Watermark Extraction/ detection:

Suspected Image Extracted Watermark Original Watermark Correlation

III. DIGITAL WATERMARK CLASSIFICATION [5]

Based on visibility of watermarks
➤ Visible Watermarks
➤ Invisible Watermarks
Based on the content to be watermarked

➤ Text Watermarking
➤ Image, Audio, Video Watermarking

Visible Watermarks
Paper Watermarks:
➤ Formed during the manufacturing process of the paper when a wet paper is taken so take the fibres can be distributed according to the design of the watermark. This mainly used for identification and the authentication. Common examples are: currency notes, stamps, logos used on television channels [5].

IV.WAYS TO PRODUCES WATERMARK ON PAPER:

Talking about visible Watermarks , they vary greatly in their visibility, some watermarks are directly visible while some are observed on casual inspection, others require a special study to detect . Watermark Fluid is one of the various aids developed for paper watermarking. In this method the paper is wetted without damaging it. Watermarks are often used for security and information hiding [6] which can be implemented banknotes, passports, postage stamps, and other documents to prevent counterfeiting. In the examination of paper a watermark is very useful because it can be used for dating, identifying sizes, mill trademarks and locations, and the quality of a paper. The process of watermarking is as follows:

a) Dandy Roll

A watermark is made by impressing a water-coated metal stamp or dandy roll onto the paper during manufacturing. Introduction of watermarks first can in first introduced in Fabriano, Italy, in 1282 the invention of the dandy roll in 1826 by John Marshall revolutionised the watermark process and made it easier for producers to watermark their paper.
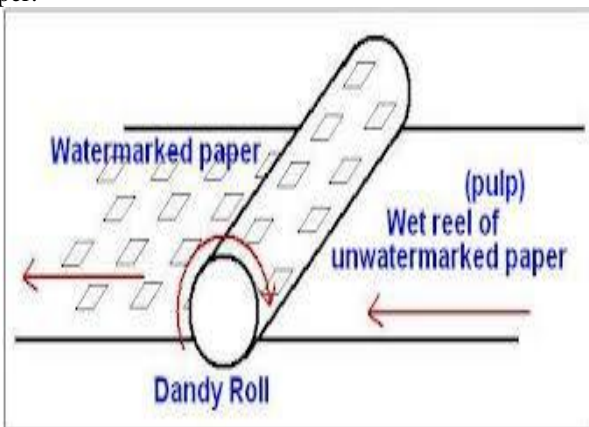
Depicting the Dandy roll process

A light roller covered by material similar to window screen that is embossed with a pattern , this is known as Dandy Roll. Laid wires are used to make faint lines that run parallel to the axis of the dandy roll, and chain wires are used to make bold line that run around the circumference to secure the laid wires to the rollfrom the outside. The laid wires are located on the inside of the chain wires, the chain wire has a greater influence on the impression in the pulp, showing their bolder appearance than the laid wire lines. [7]

Image of Dandy Roll

b) Cylinder Mould watermark:

The second type of watermark is the cylinder mould watermark. And the reason for the exclusiveness of this type is for the protection it provides against the counterfeiting. The design's attractiveness results in readily recognized security feature available for authentication of banknotes to general public the authentication. Central banks of all the world's major currencies act on recommendation to embed watermarks to protect the currency against counterfeiting of banknotes. The shaded watermark is created by areas of relief on the roll's own surface rather than using a wire covering for the dandy roll. The watermarks made by this method is more detailed and clear than the dandy roll method.

A clear watermark showing a US postal stationary envelope

V. WATERMARK ON BANKNOTES

Most people are familiar with two types of document watermarks which can be found in banknotes [8] or on cheques. In banknotes, these are recognizable designs that are put into the paper on which the documents are printed, whilst in cheques they tend to be specific patterns. To prevent the people from making of fake copies these watermarks are usually used. Thereby making sure that the banknote or document is authentic.

A number of specialized printing techniques which makes it possible to have printed watermarks which on scanning or photocopying of the protected document gets vanishes. For the success of these totally rely upon the high quality printing process. To increase the success of this techniques highly professional printing is done. Mentioned here professional because the type of printing is not done normally and can't be even handle by common man. Electronic forms of documents is mostly distributed rather than printed one.

There are alot of techniques that have came into existence to protect the documents, and these techniques has raised the bar printing. Printing use magnetic inks or the special inks which create effects(as ink that change colour when they get wet) , the liquid also depends on the type of techniques. As if it will change it's colour on getting wet by water. May some other technique uses some other liquid. The specification of the liquid and inks both together provides a high level of protection and authentication.

The water-mark of the paper, on which formerly reliance was placed almost in a new fashion, put forth a difficulty in the way of the counterfeiter, but this can be seen through experiences that under ordinary circumstances it provides inadequate protection to itself. The way by which it can be imitated are known well and, since with a strong paper a distinct water-mark is incompatible, the age of a water-marked note is much less than that of one printed upon plain paper. The best bank-note paper is made up by hand from pure linen rags. Now a days, Machine-made paper is largely known, as it equivalently capable of all the strength of hand -made and even more uniform in thickness and texture.

In documents which pass current as money it is obviously the duty of the bank or government issuing them to take all reasonable means to prevent the public from being defrauded by the substitution of counterfeits; and a bank whose circulation depends upon the confidence of the public must do so in its own interests to insure the acceptance of its notes. By all issuing institutions this principle is now recognized, but in practice there is space for improvement in the issues of many important establishments, partly because of the unwillingness of the directors of a bank to change the form of an issue to which the public is accustomed, partly because of the in deciding a secure note is really a difficult task and in certain cases because, unpaid to exceptional circumstances, practically immune issue my be from the crime of falsely making (forgery) although the notes themselves present little or no difficulty in imitation.

For an issue the features essential to the security :
(1) The identity in appearance of the notes of the issue
(2) Adequate protection by properly-selected colours against photographic reproduction
(3) High-class engraving comprising geometric lathe work and well-executed decorative design. In addition it is important that the design of the note should be striking and eye pleasing and the inscription legible.

The notes of the Bank of England are printed in the bank from surface-plates in black without colour or special protection except the water-mark in the paper. On the return to the bank notes are never reused so their average life is very short. Approax 6 weeks. So that a dirty or torn Bank of England note is practically never seen.

Machine readable data is digitally watermarked into banknotes. The watermarking done by digital mechanism can be detected by various devices or can be optically sensed. The banknote reproduction can be prevented by the result of such devices. Various problems can occur by this arrangement addresses e.g., the use of digital image editing tools to circumvent other banknote anti-copy systems.

Articles presently relates the use of digital watermarking with the banknotes and other important secure documents, for the security purposes. In India, the use of 15 languages have been done to write the amount of each banknote. On the obverse side, written in English and Hindi language has its denomination. 15 of the 22 official languages of India has a language panel that displays the denomination on the reverse of each note. Assamese, Bengali, Gujarati, Kannada, Kashmiri, Konkani, Malayalam, Marathi, Nepali, Oriya, Punjabi, Sanskrit, Tamil, Telugu and Urdu are the languages included in the panel. And these are displayed in the alphabetical order.

Advantages of using document watermark:
There are alot of advantages to the publisher for using watermarks in documents
➢ copying deterrent
➢ as a way to identify the source of a printed document
➢ as a way to determine whether a document has been altered

### VI.EURION CONSTELLATION : (A WAY TO DETECT THE DOCUMENT)

The **EURion constellation** [9] since about 1996 is known worldwide. It is a pattern of symbols incorporated into a number of banknote designs. It is added to help imaging software detect the presence of a banknote in a digital image. With the help of such Software the user can block the reproduction of banknotes to prevent counterfeiting using colour photocopiers. Recent researches shows that in currency detection the EURion constellation may just be one of many factors been used [10].
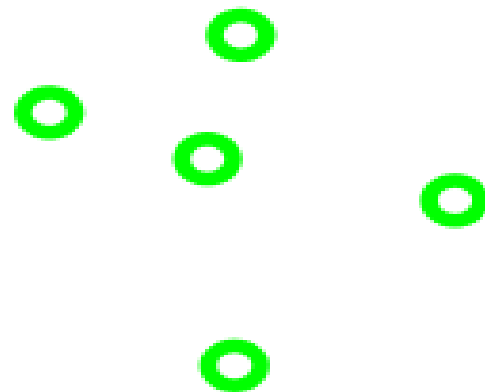
The EURion constellation is made up of five rings.

Markus Kuhn, gave the name "EURion constellation", while experimenting with Xerox colour photocopier in early 2002 refused to reproduce banknotes. He uncovered the patterns. The EURion constellation consists small yellow, orange and green colour circles patterns of five rings , which is repeated across areas of the banknote at different orientations, was first described by Kuhn. The mere presence of five of these circles on a page is sufficient for some colour photocopiers to refuse processing. Simple integer ratios between the squared distances of nearby circles was noticed by Andrew Steer which gives further clues as to how the pattern is meant to be detected efficiently by image-processing software.

The EURion constellation was first recognised on the 10 euro (€10) banknote. This was prominently used for the currency detection. To get hold on the illegal means of reproducing currency is really very important as for each country this the most difficult task.
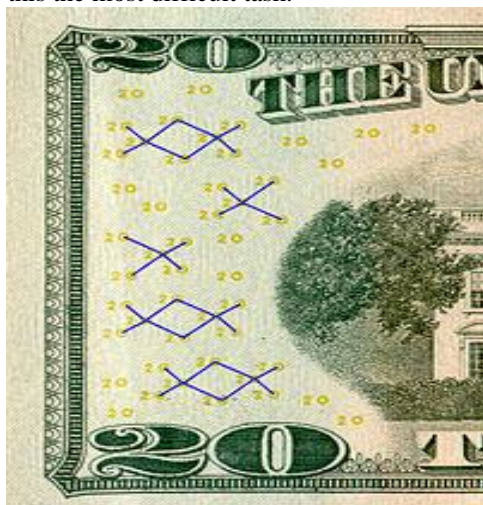
EURion constellations made by circular zeroes on a US $20 bill (marked in blue).

VII. CCONCLUSION

The purpose of this paper is survey about the concepts of watermarking and how it is commonly used in are day to day lives. The example of it is banknotes and stamps. The whole paper contains the one type of process of watermarking that is paper watermarking which is the type of visible watermarking. The comprehensive review of literature made has uncovered various aspects of Digital Image watermarking. To conclude with how Digital Watermarking is an effective and impressive tacit for the image authentication and protection from the different unauthorized means.

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