

Forensic Examination of Denomination of Indian Currency of Rs. 2000: An Instrumental Analysis (Docubox HD)

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Abstract

We have studied various security features of higher denominations of Indian currency (Rs 2000), including the detailed examination of the new Mahatma Gandhi series and the identification of the counterfeit banknotes using the security features present in each denomination. Since cases of counterfeit currency notes employing sophisticated printers are on the rise, forensic document examiners are frequently questioned about the authenticity of paper money. All security features cannot be examined under the conventional instruments and thus do not give the required results. To establish the same, the most advanced instruments like Docubox HD have been used to accomplish the aim.

In this paper, most of the security features present in the denominations have been presented. This helps differentiate genuine notes from fake ones. Most often, ultraviolet, regular, transmitted, and oblique light are used when examined. Several security features were discovered, including fluorescence, watermarks, micro text, security threads, latent images, optical fibers, omron features, identification mark, inset letters, angular bleed lines and intaglios. Different ranges of wavelength present in the instrument showed differences in the appearance of the fluorescent feature. To prevent counterfeiting, Indian currency also has a number of security features that are periodically updated and improved by the Reserve Bank of India.

Keywords: Counterfeit; Docubox HD; Examination; Fluorescence; Authenticity

Introduction

Currency is a widely acknowledged form of money, including coins and paper notes, that is issued by a government and circulated throughout an economy as a means of exchange for goods and services. The majority of countries have assigned central bank's authority for issuing national currency. The Indian rupee (sign: ₹;INR) is the official currency of the Republic of India. The Reserve Bank of India oversees currency issuance [1]. Security elements on a banknote are mostly found on the paper, design, and printing process. Various additional security elements are periodically implemented to make counterfeiting more challenging [2]. All banks have received a master circular from the RBI regarding the identification and impoundment of counterfeit notes, feeding ATMs prior to issuing over counters India's legal framework for counterfeiting Section 28 of Indian Penal Code describes "counterfeiting" while the punishment for

the mentioned offence is stated in Section 489 (A), (B), (C) and (E) mentioning imprisonment for 10 years along with charging of fine. It is deemed as a "non-Ba liable, Cognizable Offence" and triable by the Court of Session [3,4].

Material and Methods

The research work is based on the spectral analysis of the Indian currency notes. For the following work Indian currency notes of 2000 and 500 are taken. The security features were examined under the following instruments:

Docubox HD

The procedure is followed for Docubox HD also describe the material and method properly in a paragraph and after that describe instruments handling this research (Table 1,2).

Table 1: Systematically Arrangement of Instruments Comparison.

Wavelength	Features	Docubox HD
254nm	Security thread	Not that much clear windows of security thread observed.
	Optical fibres	Few and not all 3 colours can be observed.
	Omron features	Observed but not that bright
313nm	Security thread	Much clear than seen under 254nm.
	Optical fibres	Yellow, blue and red optical threads observed but few in numbers
	Omron features	Clear and bright
365nm	Security thread	Emits fluorescence and micro letters seen clearly. Micro lettering (RBI and BHARAT) observed.
	Optical fibres	More number of optical fibres can be observed.
	Omron features	
	Micro lettering	Could not be observed under docubox HD

Table 2: Currency Dimensions and design arrangement Denomination.

Denomination	Main colour	Dimensions (mm)	Design on the reverse side
2000	Magenta	166 mm × 66 mm	Mangalyaan
500	Stone grey	150 mm × 66 mm	Red fort
200	Bright yellow	146 mm × 66 mm	Sanchi stupa
100	Lavender	142 mm × 66 mm	Rani ki vav
50	Fluorescent blue	135 mm × 66 mm	Hampi with chariot

Examination Under Docubox HD

Watermark and electrotype watermark given figure shows the watermark and an electrotype mark in 2000 rupee.

Denomination – 2000

Security Features of Indian Currency Notes

Watermark (Figure 1)

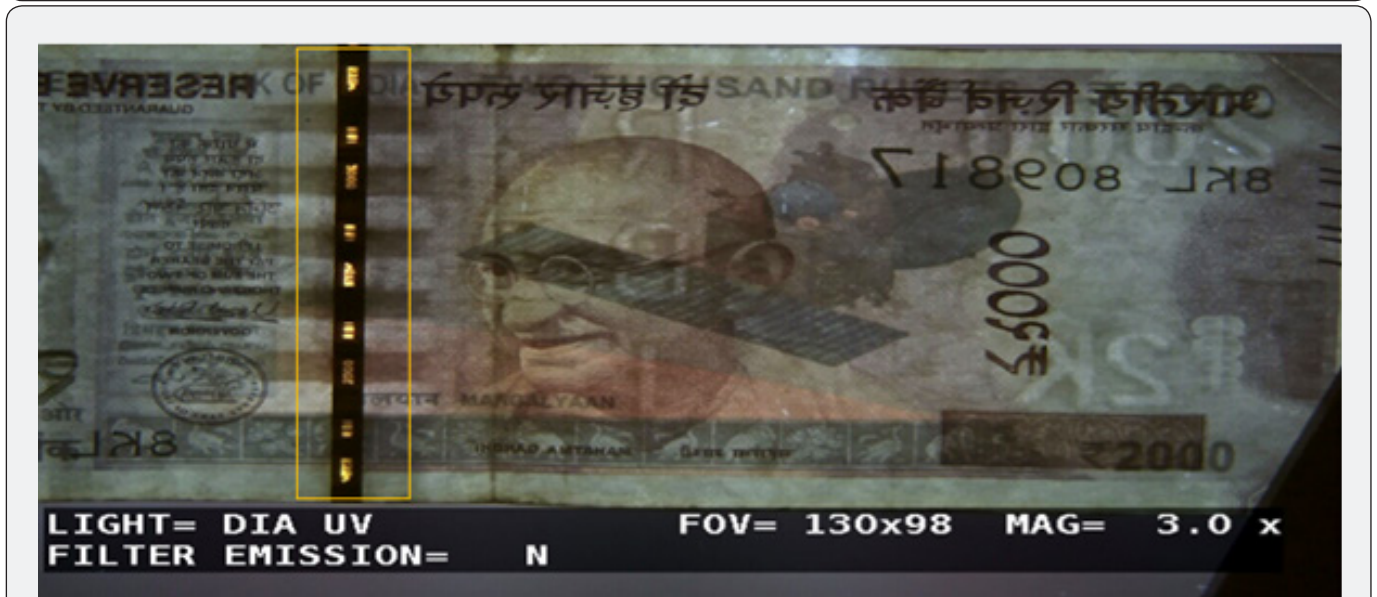


Figure 1: Paper currency note of Rs. 2000 showing watermark of the Mahatma Gandhi portrait and electrotype watermark in visible light.

Electrotype watermark (Figure 2,3)



Figure 2: Paper Currency note of Rs. 2000 showing watermark (1) of the Mahatma Gandhi Portrait and electrotype watermark (2) under SPOT.



Gandhi watermark under DIA UV light source.

Figure 3: Paper Currency note of Rs. 2000 showing RBI secret watermark besides Mahatma.

Security Thread (Figure 4-11)



Figure 4: Paper currency note Rs. 2000 showing green colour security thread in visible light.



Figure 5: Paper currency note of Rs. 2000 showing RBI secret watermark 2K and 2000 under DIA light source.



Figure 6: Paper currency note Rs.2000 showing fluorescent feature by security thread on the obverse side in 313nm UV light.

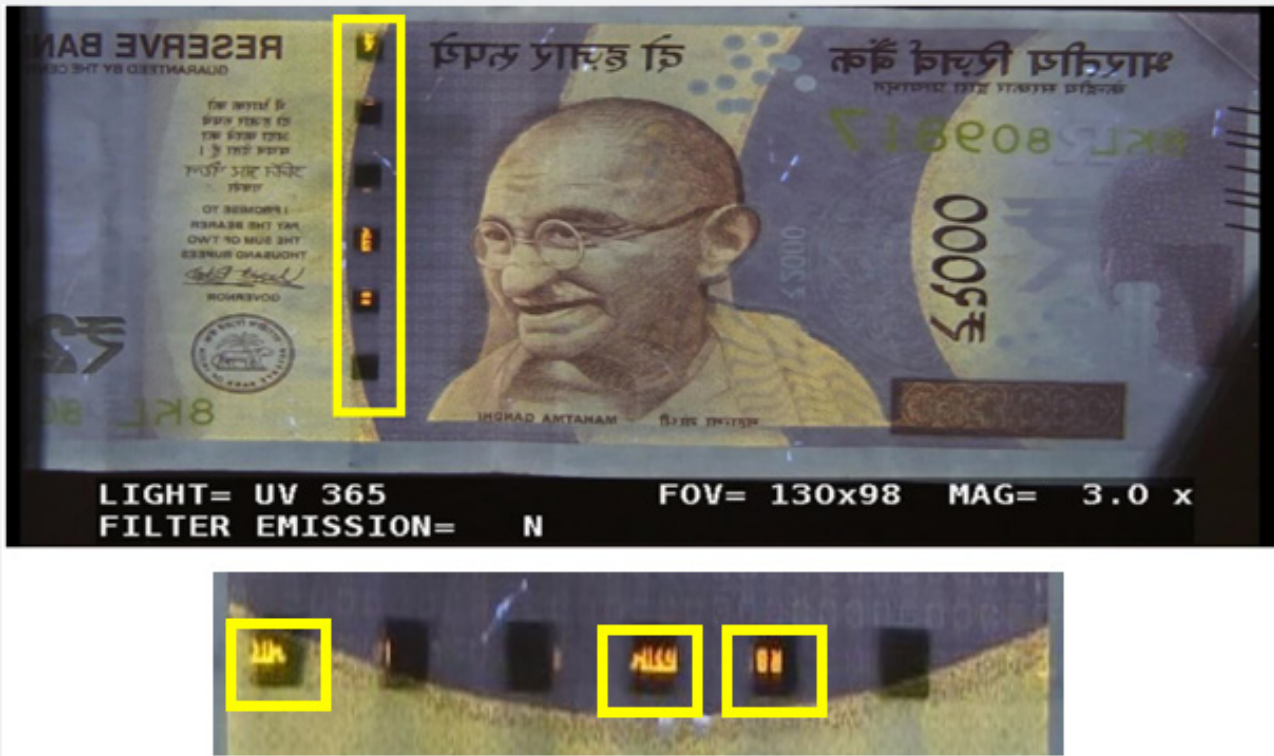


Figure 7: Paper currency note Rs.2000 showing fluorescent feature by security thread in 365nm UV light. Micro letters RBI can be seen clearly and BHARAT in Hindi language can be seen.

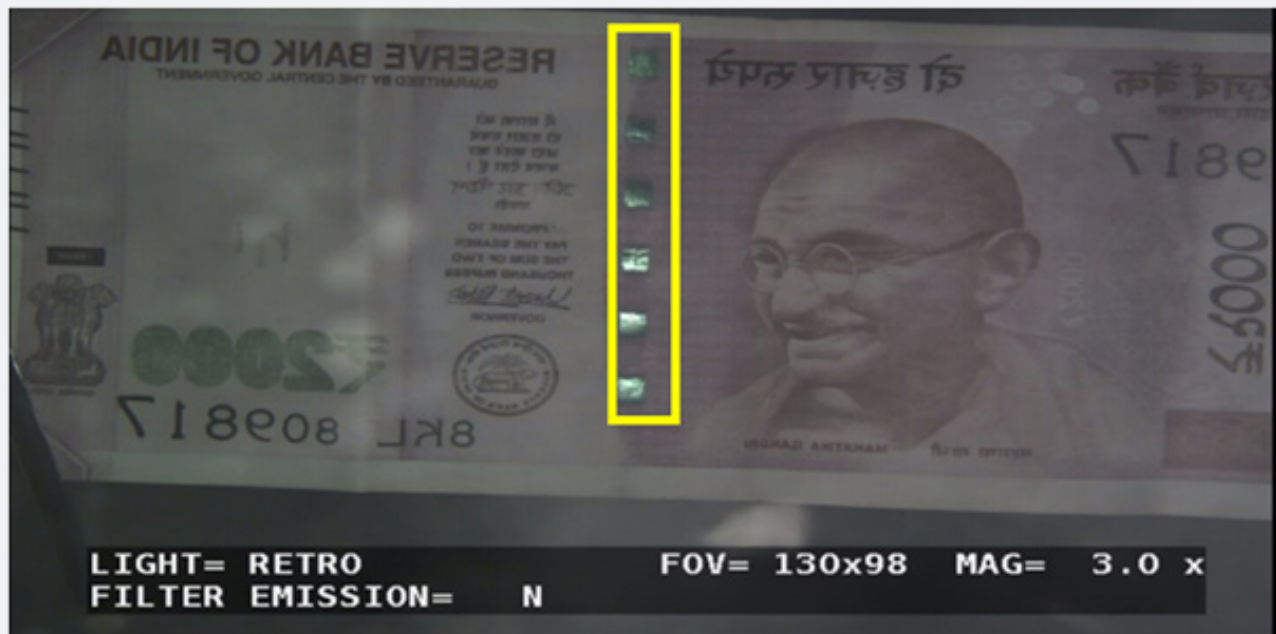


Figure 8: Paper currency note Rs.2000 displaying six windows present on the security thread clearly under Retro light.

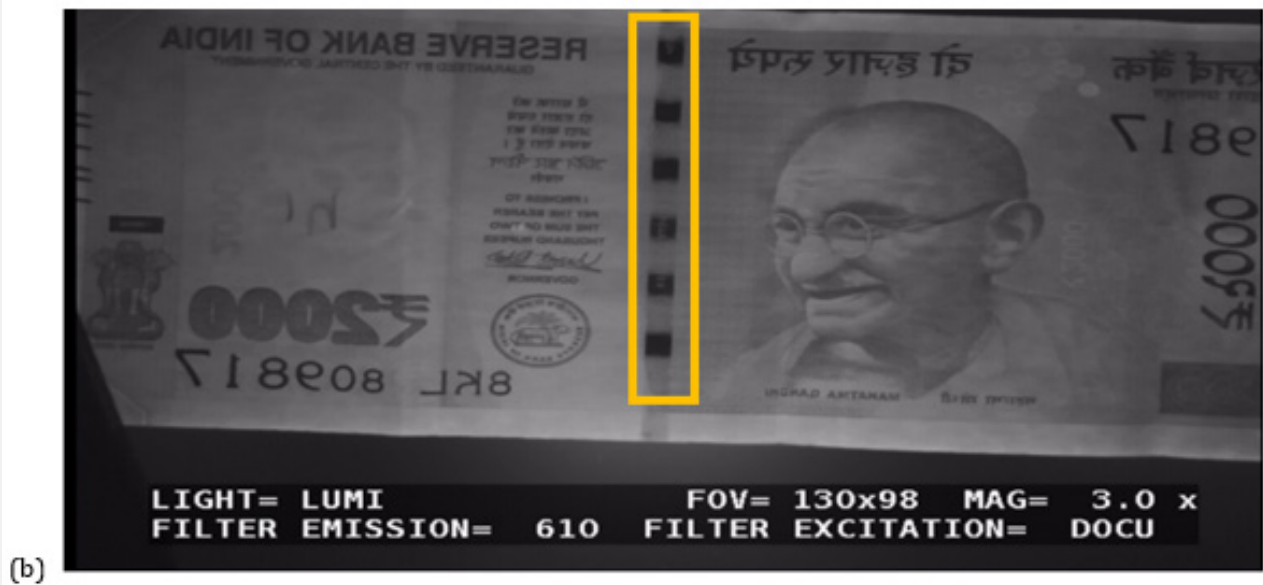


Figure 9: (A) and (B) Paper currency note Rs.2000 showing security thread under luminescence light.



Figure 10: Paper currency note of Rs.2000 showing micro letters RBI and 2000 and BHARAT in Hindi on security thread which is fully embedded and continuously readable on the reverse side.



Figure 11: Paper currency note of Rs. 2000 visualised under DIA filter which displays security thread in black colour along with the micro letters.

See Through Register (Figure 12,13)

It denotes the denomination numeral 2000 (in 2000 bank note) when seen through different angle. This feature is present on both sides of the currency note.



Figure 12: Paper currency note of Rs.2000 showing see-through register in visible light.

- a. On the obverse side
- b. On the reverse side.



Figure 13: Paper currency note of Rs.2000 showing see-through register in luminescence light.

Optical Security Fibres

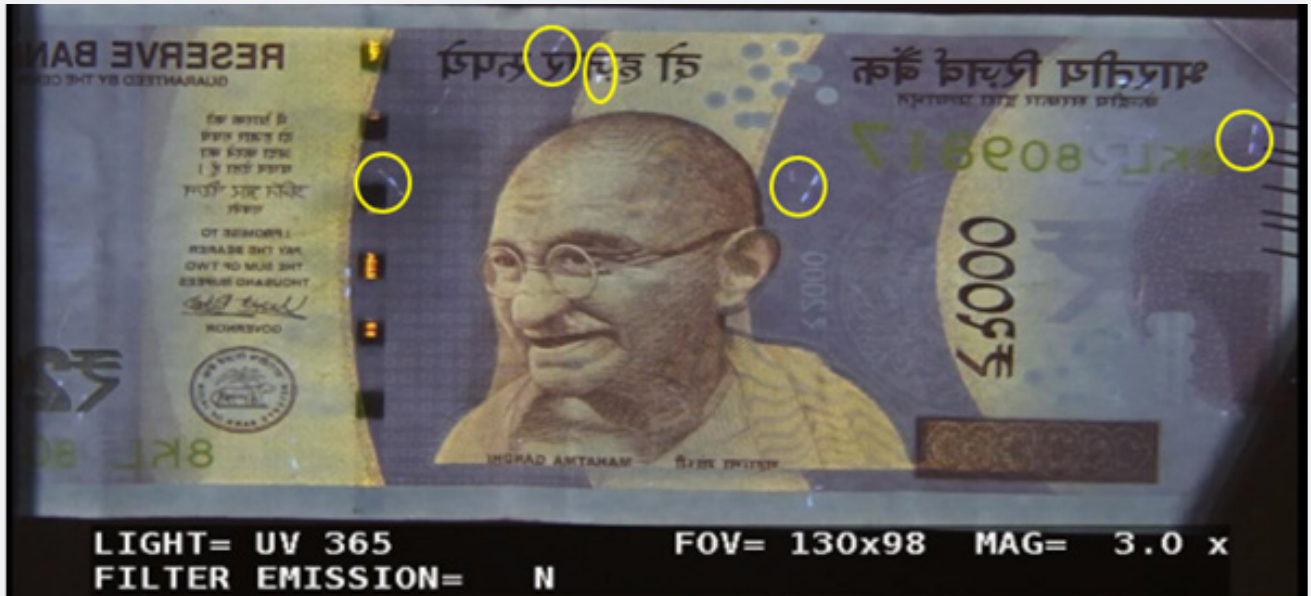


Figure 14: Paper currency note of Rs 2000 showing optical threads giving blue fluorescence under 365 nm UV.



Figure 15: Paper currency note of Rs. 2000 displaying intaglio printing in visible light.

Genuine paper currency notes contain three different coloured optical fibres: yellow, blue, and red. Under ultraviolet light, these tiny fibres can be seen on both sides of the note (Figure 14).

For Visually Impaired:- The following features have been mentioned.

Intaglio Printing

The image of Mahatma Gandhi, the Reserve Bank seal, the guarantee and promise clause, the Ashoka Pillar emblem, the

governor's signature on the RBI, and the identifying mark for people who are blind are all printed in an upgraded intaglio manner with a raised printing. By lightly rubbing the note's obverse side with finger, we may feel this style of printing (Figure 15).

Identification mark

This feature is present on the lower right side on the obverse side and above the image of As the National Emblem. The identification mark is different for every denomination. For Rs. 2000 we have a rectangle shape (Figure 16).



Figure 16: Paper currency note of Rs. 2000 showing zoomed image of the rectangle shaped identification mark.

- a. In Visible Light
- b. In 365 nm UV



Figure 17: Angular bleed lines present on both left and right side of the currency note.

Angular Bleed Lines

This feature is present on both the sides of the currency note of the obverse side in form of number of horizontal lines. In 2000 bank note there are 7 angular bleed lines (Figure 17).

Language Panel

The language panel appears on the reverse side of the bank note displaying the denomination in 15 different languages plus 2 more language including english and hindi (Figure 18).



Figure 18: Language panel present on the reverse side of the currency note of Rs. 2000.

Swachh Bharat Mission logo

Bank notes of new Mahatma Gandhi series includes the logo

of Swachh Bharat Mission along with its logo “One step towards cleanliness” in Hindi (ek kadam swachhta ki orr) on the bottom left of the reverse side of the bank note (Figure 19).

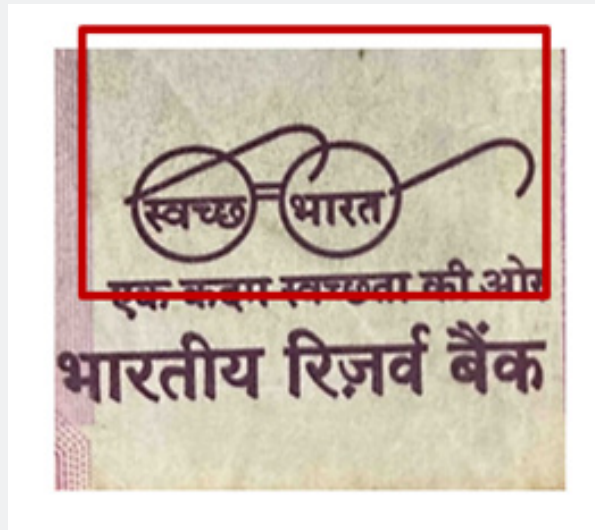


Figure 19: Paper currency note of Rs.2000 displaying Swachh Bharat logo and slogan on the reverse side.

Micro lettering

(Figure 20)



Figure 20: Paper currency note of Rs.2000 displaying micro printing RBI and 2000 and BHARAT (in Hindi) present on obverse side under visible light.

Omron Features

Small circle like designs are present (Figure 21-23)

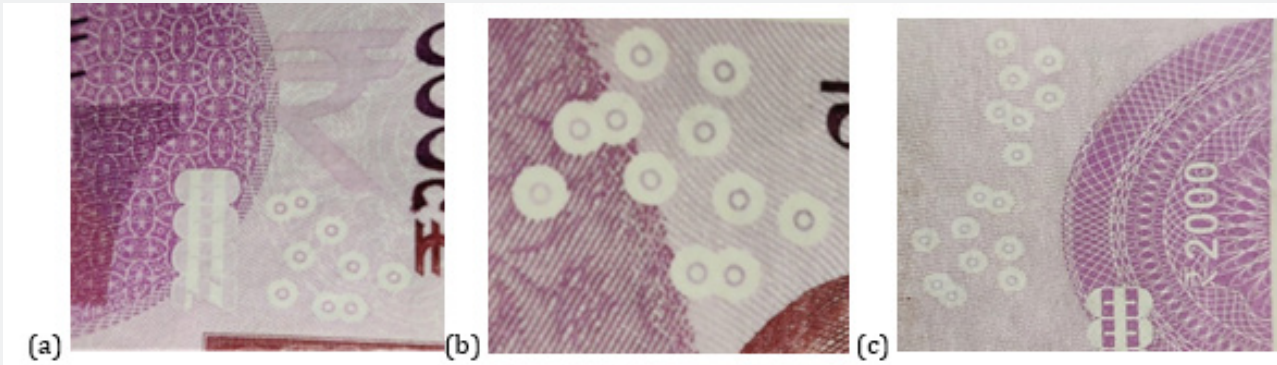


Figure 21: Paper currency note of Rs.2000 displaying Omron features present on the obverse side under visible light. (a) and (b) on the obverse side and (c) on the reverse side of the bank note.

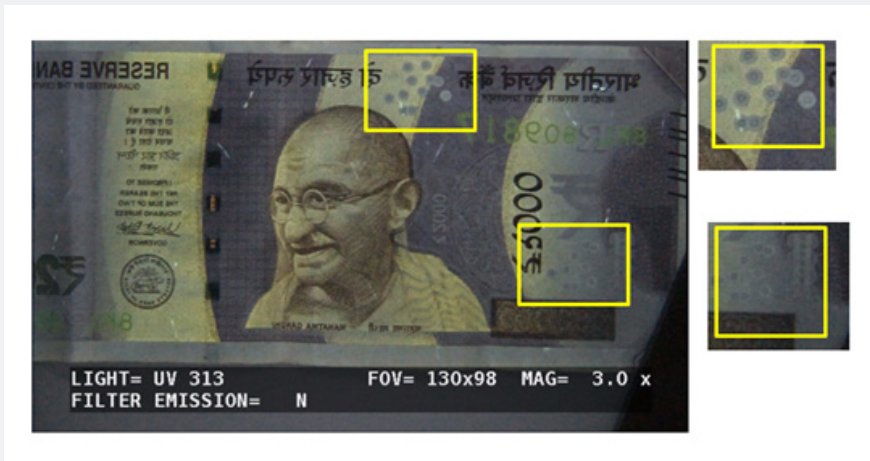


Figure 22: Paper currency note of Rs.2000 displaying Omron features present on obverse side under 313 nm UV light.



Figure 23: Paper currency note of Rs.2000 displaying Omron features present on obverse side under 365 nm UV light.

Number Panel

Number panel present on both top right and lower left corner of the banknote gives fluorescence under UV source. The

number panels of the banknotes are printed in fluorescent ink. The banknotes also have dual-coloured optical fibres. Both can be seen when the banknotes are exposed to ultra-violet lamp (Figure 24,25).

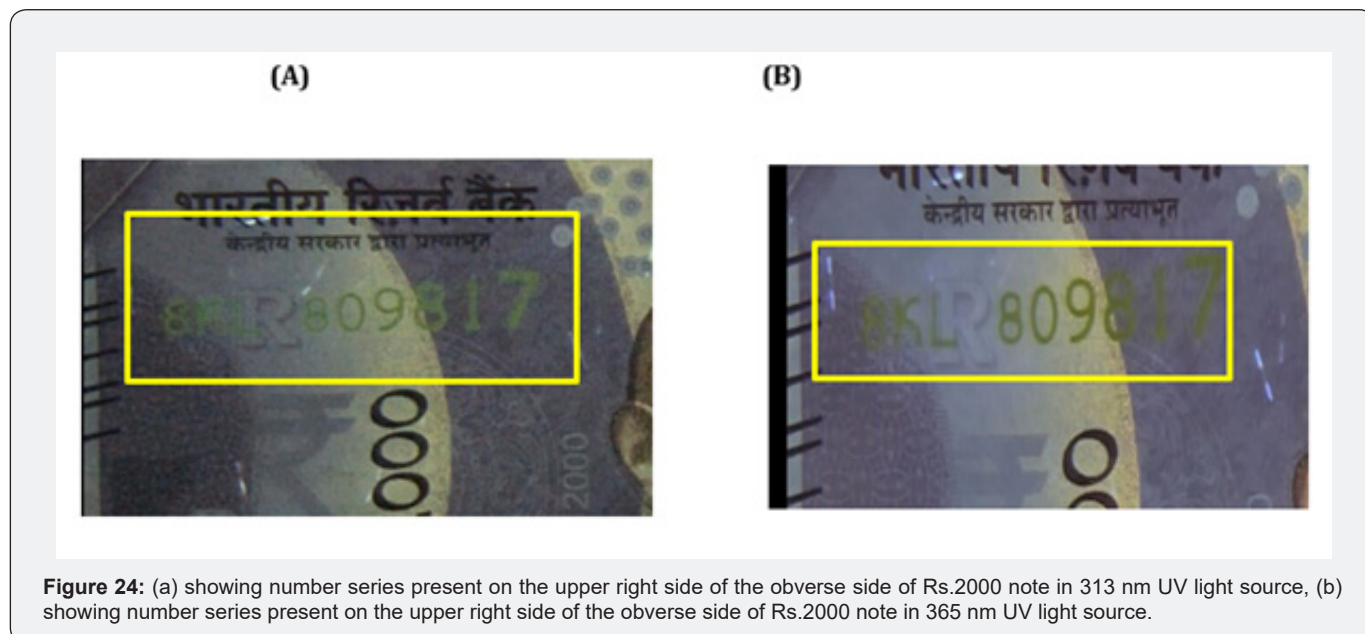


Figure 24: (a) showing number series present on the upper right side of the obverse side of Rs.2000 note in 313 nm UV light source, (b) showing number series present on the upper right side of the obverse side of Rs.2000 note in 365 nm UV light source.



Figure 25: Paper currency note of Rs.2000 showing number panel in visible white light.

Result and Discussion

The major concern in the result of instrumental analysis working, and analysis of currency features and clearly visual and identifies the watermarks and the other security features with the help of docubox HD instruments, the systematically approach was defined only is the focus security features analysis, the security features was mentioned in the various type of colors and properties the mentioned the Omron features and micro printing and watermarks. Different type of ranges of docubox is examines the currency and listing of ranges.

Conclusion

In this review, we have proposed a framework for Indian money note order in view of section as well as fake confirmation. Our proposed framework can distinguish the division of the money note with a precision of 98.50%. The Multiscale Template Matching framework for money fake recognition has its limits. It

can distinguish the security highlights from the front picture of the money note. We plan to remember the other side highlights for fake identification for what's to come. mentioned all features characteristics in the review and major concern in future aspect is counterfeiting things.

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