

Study of Genuine and Forged Indian Bank Cheques by Using Video Spectral Comparator-40

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Abstract

Financial transactions increase according to the economic growth of the nation. As India's economy is growing rapidly large amount of money transactions are increasing rapidly. Apart from currency notes and credit/debit cards cheques plays very vital role in transaction of large amount of money for their ease and convenience. Due to this cheques are vulnerable to forgeries by anti-social elements. This is the reason why cheques are incorporated with various security features. RBI implemented CTS guidelines in year 2010 for better protection of cheques from forgeries. CTS guidelines recommends different banks of India to implement some mandatory and desirable security features. In present study an attempt is made to prepare cheques by imitating some security features of genuine cheques after examination and analysis of the security features recommended by CTS-2010 using Video Spectral Comparator-40. The study is helpful in testing the credibility of security features as per CTS-2010.

Keywords: Cheques, Cheque Truncation System, Security Features, Transaction, Video Spectral Comparator.

1. Introduction

The use of Cheque is evident in the world from the time of ancient Persian kingdom. In India it prevailed from the Mauryan era, where they use to issue an order or "adesh" to the banker to pay a third person. India has very long history of payment instruments and mechanisms in which currency plays an important role.

Paper currency which is being used in modern world has its origin in late 18th century. Earlier there were some disagreements among the private banks as well as semi-government banks like Bank of Hindustan, the General Bank in Bengal and Bihar, and the Bengal Bank regarding paper currency. Later, this job of establishing the note was taken over by the Presidency banks. The Negotiable Instrument Act (NI Act) was enacted in 1881. This act formalized the usage and characteristics of instruments like cheque, the promissory note and the bill of exchange. According to this act, a "cheque" is a bill of exchange drawn on specified banker and not express to be payable otherwise than on demand. For systematic working the banks emerged cheque clearing process. In the presidency towns, clearing associations were formed by banks. The Calcutta Clearing Banks' Association adopted clearing rules in 1938. Under the RBI Act 1935, Reserve Bank of India was set up and the Clearing Houses in the Presidency towns were taken over by Reserve Bank of India. In 1770 the cheque was introduced by Bank of Hindustan in India soon after its establishment at Kolkata (that time Calcutta) by the European management.

During clearance of cheques at the cash counters, many investigating agencies as well as nationalized banks and private banks encounter fraudulent activities. Due to insufficient security features or lack of security features and their simple appearance they make any layman vulnerable to forgery. Manipulation of documents become easier due to the advancement of digital scanning and a printing technology. It becomes the duty of Forensic Document Examiner that he should examine the documents and evaluate their authenticity.

By using advanced scanning-printing instrument and such recent advanced technologies it is possible to deceive the layman. Many cases of cheque forgery are related to the phenomenon of interpolation while in other similar cases it is observed that the forger scans the whole cheque leaf and imitate it by using advanced printers which can produce almost exact replica of the original cheque. ^[1] Before implementation of CTS (Cheque Truncation System) cheques did not contain sufficient security features to be identified clearly. So, the Reserve Bank of India implement Cheque Truncation System in the National Capital Region (NCR), New Delhi, Chennai and Mumbai with effect from February 1, 2008, September 24, 2011 and April 27, 2013 respectively. Since new cheques contain sufficient security features which makes it hard to be copied, making it more safe for transaction. There is a standard method of operation in bank for financial transactions done by cheques. A cheque should always be in writing and signed by drawer and issued by a specified bank. The amount which is specified in cheque should be clearly mentioned both in figures and words. Also the payee of the cheque should be specified. Suppose the cheque does not bear a date then it should be invalid for transaction.

There are some special features are added in piece of paper with motive of differentiation from normal paper to other paper to make it authenticated like currencies, bank notes, passports, stamp papers, voter's ID, cheques, etc. These special features are

called security features. The main aim of these features is to prevent the counterfeiting of various documents which carries economic values as well as prestige of country. So in terms of dimensions these features are needed to be accurate and specific. Among these security features it is necessary that some features should be known to layman also so that he can identify the document on their own and if required the same can be further authenticated by the concern authorities.

Security features introduced in Cheque under the scheme of CTS (Cheque Truncation System) are introduced as given below: -

1) Watermark- Watermark is incorporated during the process of manufacturing stage of the paper. All new cheques forms to be printed with standard watermark. The words “CTS-INDIA” are also incorporated along with the watermark. When cheque form is held against any light source the watermark becomes visible. The watermark has to be oval in shape. It must have bigger diameter as 3.0 centimeters and smaller diameter as 2.6 centimeters. At least one full watermark should be contained by Cheque. The logo which is mentioned below referred by banks to follow the standard format. The name/logo watermark is also incorporated in bank Cheque in same “dandy” procured for CTS-INDIA watermark.

2) VOID Pantograph- This security feature is incorporated in cheque during the printing stage. The pantograph with hidden/embedded word “VOID” at lower left hand corner is present in all new cheque forms as per CTS—2010. These “VOID” pantographs prevent the fraudulent duplication which is not visible on either grayscale (100dpi) or binary (i.e. black and white) (200dpi) images captured from original cheques under CTS clearing environment.

3) Ultra Violet-UV Logo of Bank- This security feature is also incorporated at printing stage. The logo of bank should be in printed form which is present at upper left hand corner of the cheque. It should be present with bank name details or without bank name details. It all should be printed in ultra-violet(UV) ink. To establish the genuineness of cheque the logo should be visible in UV- lamps. This UV logo should be used as a fraud detector tool by banks.

4) Standard Field Placements of a Cheque- Date, payee name, figures, amount in words, drawee account number, signature of drawee, etc. should be present in cheque in standardized format. There are some banks which prints bank’s details in bilingual or multilingual. They should also be printed in standardized format.

5) Cheque Printing Colours and Background- The choice of colour is bank’s discretion but important thing is that they all should be printed in light pastel colours. The care should be taken while selecting cheque printing colour. The colour should be selected in such a way that Print Contrast Ratio/ Dynamic Contrast Ratio (PCR/DCR ratio) should not exceed 60% under Cheque Truncation System(CTS) clearing. For improving the quality and clarity of images under CTS environment background of cheques should be kept blank and without any kind of printing.

6) Printing of Account Number Field- It must be typewritten and if not then use rubber stamp for imprinting account number but should not have hand written.

7) Micro Lettering- This security feature is not visible by naked eye and the use of magnifying glass is must for visibility. Many of the bank cheques have own bank’s name in micro lettering feature. The enclosed sample can be referring by bank for micro lettering placement.

8) New Rupee Symbol- The new rupee symbol instead of using bilingual format at CAR (Courtesy Amount Recognition) amount in figure field.

All new cheque forms should carry printer name along with printing “CTS- 2010” for establishing CTS 2010 compliance.

Some Additional Features-

1) Cheque Design- There are such branding signatures issued by every bank, whether government or private, from which a common man can easily identify to which bank the particular cheque belongs. Bank name, branch name, branch address and branch code, bank logo and holograms plays an important role in verification of identity of bank cheque.

2) Dimensions- The size is fixed for all banks cheques according to the RBI guidelines. The length of a standard cheque is 8.0 ± 0.2 inches (≈ 202 mm) and the width is 3.66 ± 0.2 inches (≈ 92 mm). The diagonal length is 8.8 ± 0.2 inches (≈ 220 mm). The length of the white strip for MICR on the bottom of the cheque is 8.0 ± 0.2 inches (≈ 202 mm) and the width is 0.5 ± 0.2 inches (≈ 13 mm). The length of the Amount box is 1.55 inches (≈ 39 mm) while the width is 0.34 inches (≈ 8.5 mm).^[3]

3) Uniform Paper Quality- MICR (Magnetic Ink Character Recognition) cheque paper is the paper which is used for manufacturing of cheque. Generally, 95 GSM (gram per square meter) bond paper is used. The paper is manufactured in such a way that they can be protected from alterations. Alterations may include use of erasures (mechanical/chemical). Chemical erasures may include acids, alkalis, bleaches, organic-inorganic solvents, etc.

Desirable Features-

Security features mentioned as above are the mandatory features given by CTS-2010 INDIA. In addition to that features banks can add more features also. They include

Supplementary watermark containing their own logo, fugitive ink, fluorescent fibers, toner fusing, bleeding ink, security thread, holograms, patterns, floral designs, auto-detection tools, use of UV band on sensitive and key areas of interest on a cheque.

2. Materials and methods

A total of ten genuine cheques issued by ten different banks were taken for present study. Cancelled genuine cheques were collected randomly from volunteers by making them aware regarding the purpose of the present study and total ten duplicate cheques were prepared by using instruments like scanner and laser printer. The genuine cheques were scanned at 300 dpi, 600 dpi and 1200 dpi by using scanner (1136MFP of HP). The scanning images on 1200dpi were selected and colour prints were taken by using laser printer (Bizhub press- C1060).

In preliminary examination of genuine and prepared cheques were examined by naked eye and visible light source and the features seen then noted in systematic manner which has been considered valuable for the further analysis. Aim of this preliminary examination is the detection of some security features which are easily detected by naked eye. They were further analyzed by using VSC-40. Video Spectral Comparator-40. Instrument used in the work is the Windows™ based software version 6.6 (*Build 161*) embedded in VSC-40 from *Foster+ Freeman*. It provides an illumination by flood light, UV-365, UV-312, UV-254, transmitted light, spot lamp, coaxial light, anti-strokes and light from right and left side. By using various instrumental parameters and lighting conditions various features such as Micro lettering, VOID pantograph, watermark, supplementary watermark, Ultra Violet-UV logo of bank, security fibers, new rupee symbol, printing information, account number, dimensions of “CTS INDIA” watermark were observed. It provides instant results with easier use. It is an imaging device which allows an examiner to analyze various documents for security features, inks, alterations, obliterations examination. The sample i.e. genuine and prepared cheque was placed on the platen which is in the VSC-40. The sample was viewed under different light sources and simultaneously the software running on screen on the monitor gives the image of that sample. The sample is viewed sequentially under light sources such as first under visible incident light followed by U.V. incident light with ranges 365nm, 312nm and 254nm. After that it was viewed under U.V. transmitted light (365nm), visible transmitted light and then coaxial light. After completing this the measurement of watermark was taken by using ruler option present in VSC-40. The same procedure was followed for all the genuine and forged samples of cheques.

[Sample number 1= State Bank of India; sample number 2= Central Bank of India; sample number 3= Union Bank of India; sample number 4= ICICI Bank; sample number 5= The Shrirampur Peoples’ Co-Op. Bank; sample number 6= HDFC Bank; sample number 7= Canara Bank; sample number 8= Oriental Bank of Commerce; sample number 9= State Bank of Hyderabad; sample number 10= Bank of Maharashtra]

Table 1: Observation table (sample)

Sample number	Micro lettering	VOID pantograph	Fluorescent logo	Fluorescent fibers	Account number	Printing information	Watermark	Supplementary watermark	Vertical measure of CTS INDIA logo (mm)	Horizontal measure of CTS INDIA logo (mm)
1	Present	Present	Present	Absent	Present	Present	Present	Present	25.74	30.94
2	Present	Present	Present	Absent	Present	Present	Present	Present	25.63	31.16
3	Present	Absent	Absent	Present	Absent	Absent	Present	Present	Can't measure	Can't measure
4	Present	Present	Present	Present	Present	Present	Present	Present	25.03	32.08
5	Present	Present	Present	Present	Present	Present	Present	Present	26.01	31.43
6	Present	Present	Present	Present	Present	Present	Present	Present	25.01	31.05
7	Present	Present	Present	Present	Present	Present	Present	Present	25.03	32.19
8	Present	Absent	Absent	Absent	Absent	Present	Present	Present	Can't measure	Can't measure
9	Present	Present	Absent	Absent	Present	Present	Present	Present	25.52	31.59
10	Present	Present	Present	Absent	Present	Present	Present	Present	25.41	30.67

Table 2: Observation table (prepared)

Sample number	Micro lettering	VOID pantograph	New rupee symbol	Printing information	Account number
1	Absent	Present	Present	Present	Present
2	Absent	Present	Present	Present	Present
3	Absent	Absent	Present	Absent	Absent
4	Absent	Present	Present	Present	Present
5	Absent	Present	Present	Present	Present
6	Absent	Absent	Present	Present	Present
7	Absent	Present	Present	Present	Present
8	Absent	Absent	Absent	Present	Absent
9	Absent	Present	Present	Present	Present
10	Absent	Present	Present	Present	Present

3.Result and discussion

Present work was carried out to analyze security features embedded in Indian bank cheques according to the CTS-2010 and compare the features between genuine and prepared cheques. Various security features are observed under different light conditions. Among these security features some are mandatory features and some are desirable features.

The results obtained from the experiment are mentioned sequentially as follows-

- 1) Micro lettering- Most of the cheques from banks contains the micro lettering. The lines on which we write amount to be drawn out from bank is printed in form of micro letters consist the name of the bank to which it belongs. These micro letters can only be seen under sufficient magnification. In case of prepared cheques the micro letters are not visible when the cheque is examined under sufficient magnification (Figure no. 2). But if these prepared cheques was observed with naked eye the individual can't differentiate between genuine and prepared cheques. In some bank cheques the micro lettering is blurred (figure no.1) which can make confusion to examiner whether the given cheques is genuine or forged?
- 2) VOID pantograph- Genuine cheques of various banks shows presence of VOID pantograph when observed under VSC-40 (Figure no.3). The prepared cheque also shows the appearance of VOID pantograph when observed under VSC-40 but the printing quality is poor if observed carefully (Figure number 4). Genuine cheques shows variations in design of pantograph from bank to bank and at different time intervals also.
- 3) Watermark- Cheques of various banks when observed in visible transmitted light in VSC-40 the watermarks are visible. Even when cheque is held across the light watermark is seen in it. According to the CTS-2010 guidelines the watermark embedded should be logo of "CTS INDIA" (Figure number 5). The prepared cheques when observed under VSC-40 by using visible transmitted light source, no watermark is observed in it (Figure number 6). The quality of watermarks also varies which can create confusion between genuine and prepared. The dimensions of the "CTS INDIA" watermark is given in CTS-2010 guidelines which was followed by all CTS cheques. Due to general dimensions of CTS INDIA logo there is no standard format which can create confusion in examination of cheques. If the guidelines can modify and the fix dimension for watermark is given, then it should play an important role to avoid the forgery.
- 4) Supplementary watermark- Supplementary watermarks are also observed as same above. They can be bank logo and name. Some bank does not contain bank logo, instead of that some design is embedded in it which play a role of supplementary watermark (Figure number 7). When prepared cheques was observed no supplementary watermarks are found (Figure number 8). There is no consistency in watermark pattern present in cheques. Some bank cheques contain logo of their bank and in some bank and some are not. Also in some cheques the bank name in short form is present and in some are not. Some cheques consist of the name of bank as watermark in Devanagari and in some it is in English language. The quality of supplementary watermarks also varies i.e. some contain good quality watermarks whereas in some the quality is poor which can create confusion between genuine and prepared.
- 5) Ultra Violet-UV logo of bank & Security fibers- According to the CTS-2010 guidelines this mandatory features include bank's logo at upper left hand corner of the cheque along with or without Bank name details in ultra-violet (UV) ink. The genuine bank cheques when observed under VSC-40 by using Ultra Violet-UV light source it gives fluorescence (Figure number 9). The bank logo and security fibers are embedded in genuine cheques which gives fluorescence under Ultra Violet- UV light at different ranges (365nm,

312nm, 254nm). In some bank cheques the lined area where the amount is filled also give fluorescence. These features while examination of prepared cheques not observed in Ultra Violet-UV light (Figure number 10). Presence of security fibers is also inconsistent in cheques.

- 6) Printing information- According to CTS-2010 standard guidelines all the genuine cheques should carry “printer name” along with “CTS-2010.” In prepared cheques same feature is observed. But when the prepared cheques observed under some suitable magnification the printing quality differs from genuine cheques. In prepared cheques the printed matter shows some blurred appearance as compared to the printing on genuine cheques (Figure number 13& 14). Though the CTS-2010 guidelines only give to show the printer name and CTS-2010, some banks added the city name, time of printing, etc. information. This is good but not followed by all banks. So this format varies from bank to bank though the standard guidelines were followed. Even the variations are found in different branch of same bank according to the time interval.
- 7) Account number- The account number was incorporated in CTS cheques in printed form or stamped. The cheque in which account number is printed shows variation in printing quality when they are tried to forged. The prepared cheques when observed under a suitable magnification the printing quality is poor as compare to the genuine cheques (Figure number 15 & 16).

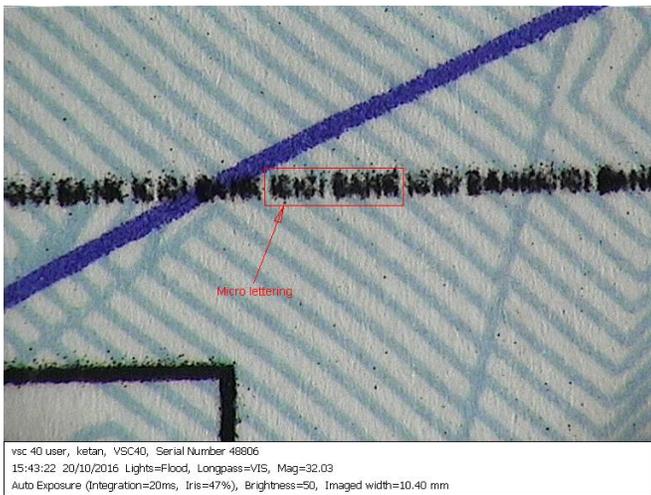


Figure 1: Micro lettering in genuine cheque

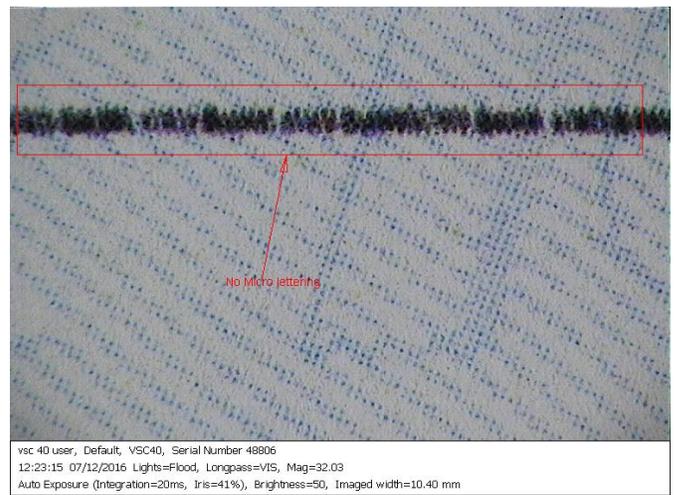


Figure 2: Micro lettering in prepared cheque

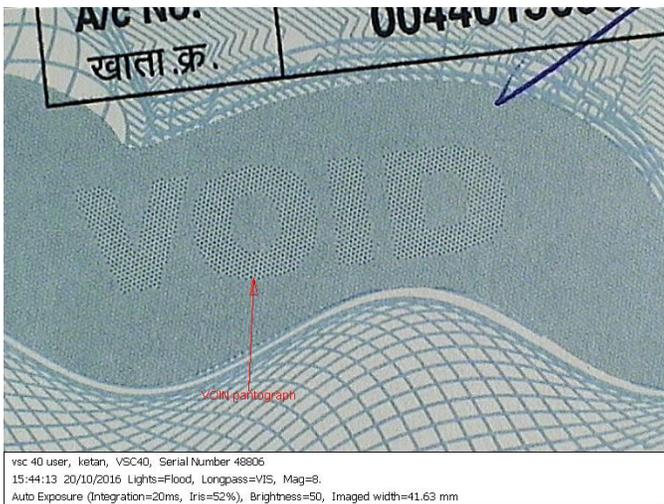


Figure 3: VOID pantograph in genuine cheque

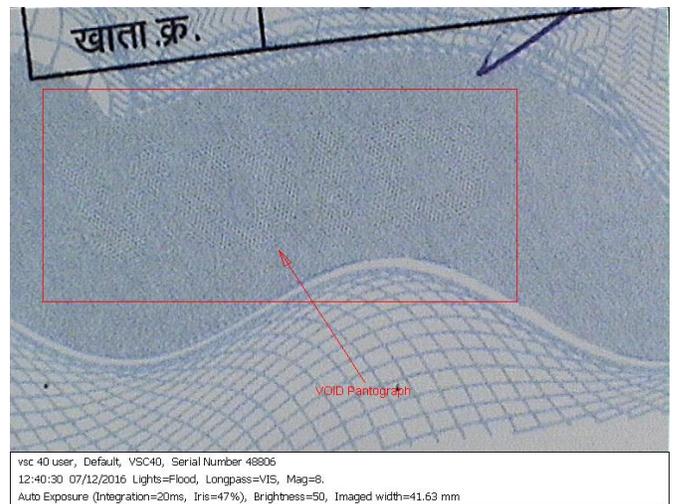
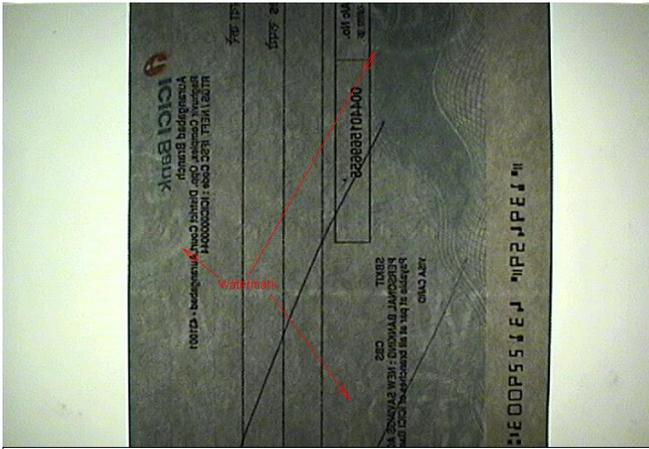
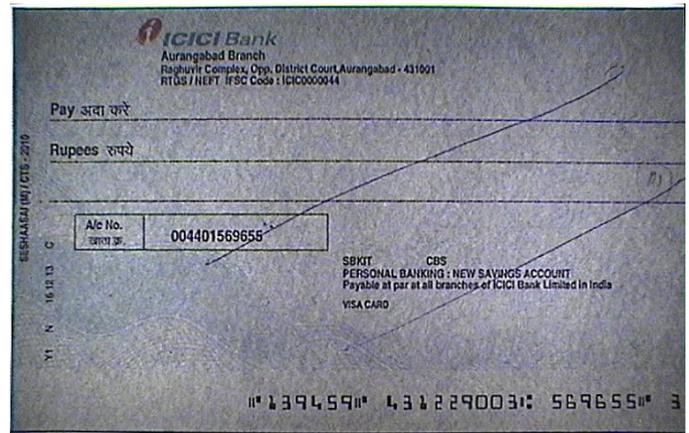


Figure 4: VOID pantograph in prepared cheque



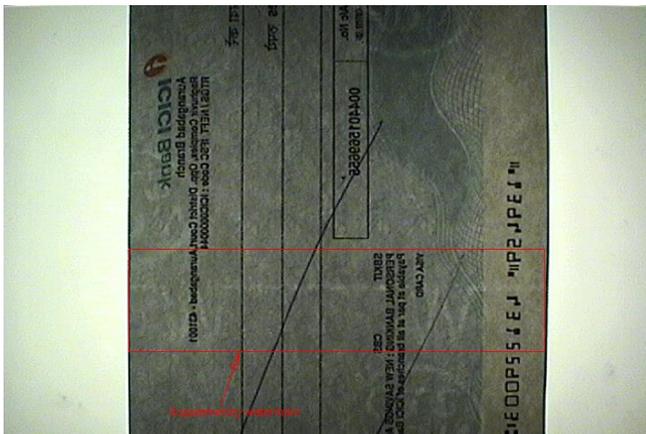
vsc 40 user, ketan, VSC40, Serial Number 48806
 15:51:42 20/10/2016 Lights=Transmitted, Longpass=VIS, Mag=2.26
 Auto Exposure (Integration=20ms, Iris=41%), Brightness=50, Imaged width=147.35 mm

Figure 5: Watermark in genuine cheque



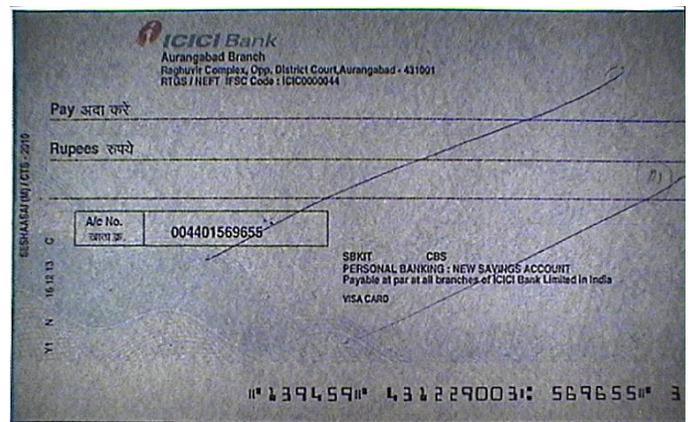
vsc 40 user, Default, VSC40, Serial Number 48806
 12:22:17 07/12/2016 Lights=Transmitted, Longpass=VIS, Mag=2.26
 Auto Exposure (Integration=20ms, Iris=47%), Brightness=50, Imaged width=147.35 mm

Figure 6: No watermark in prepared cheque



vsc 40 user, ketan, VSC40, Serial Number 48806
 15:55:16 20/10/2016 Lights=Transmitted, Longpass=VIS, Mag=2.26
 Auto Exposure (Integration=20ms, Iris=41%), Brightness=50, Imaged width=147.35 mm

Figure 7: Supplementary watermark in genuine cheque



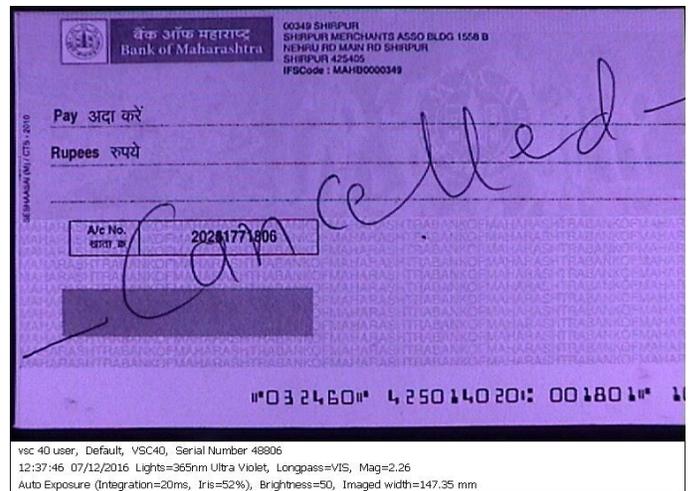
vsc 40 user, Default, VSC40, Serial Number 48806
 12:22:17 07/12/2016 Lights=Transmitted, Longpass=VIS, Mag=2.26
 Auto Exposure (Integration=20ms, Iris=47%), Brightness=50, Imaged width=147.35 mm

Figure 8: No supplementary watermark in prepared cheque



vsc 40 user, ketan, VSC40, Serial Number 48806
 15:30:13 24/10/2016 Lights=365nm Ultra Violet, Longpass=VIS, Mag=2.26
 Auto Exposure (Integration=20ms, Iris=100%), Brightness=50, Imaged width=147.35 mm

Figure 9: Fluorescent logo in genuine cheque



vsc 40 user, Default, VSC40, Serial Number 48806
 12:37:46 07/12/2016 Lights=365nm Ultra Violet, Longpass=VIS, Mag=2.26
 Auto Exposure (Integration=20ms, Iris=52%), Brightness=50, Imaged width=147.35 mm

Figure 10: No fluorescent logo in prepared cheque



Figure 17: Horizontal measurement in genuine cheque

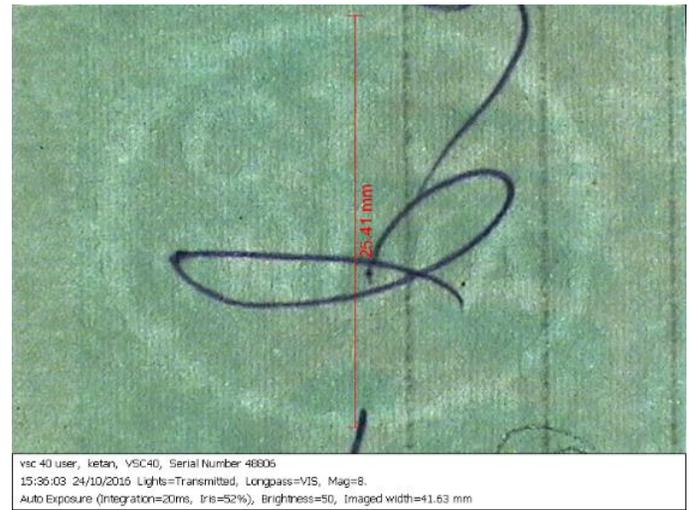


Figure 18: Vertical measurement in genuine cheque

4. Conclusion

An attempt was made to analyze some security features in prepared cheques and comparing them with genuine. After thorough examination and comparison of both genuine and prepared cheques of different banks it can be concluded that the variations in genuine cheques is found although they are prepared as per the CTS-2010 i.e. Cheque Truncation System-2010 guidelines. So the CTS-2010 guidelines must be improved to bring the uniformity and high degree of security in cheques. It is seen in the study that different genuine cheques showed variability for same security feature. The printing quality should be monetarized such that the cheques of different banks show similar features. The watermark which is incorporated during manufacturing process is present in all cheques is of “CTS INDIA.” According to the CTS-2010 guidelines the dimensions of “CTS INDIA” watermark is in such a way that it must have bigger diameter as 3.0 centimeters and smaller diameter as 2.6 centimeters. This guideline not give any standard format to this security feature. Though the guideline is followed but there is variation in cheques from different banks, from same banks and even from different branches of same banks at different time interval. The quality of watermarks is not consistent in genuine cheques. It is necessary to maintain the quality of watermarks in cheques and also to incorporate the good quality of watermarks. The paper quality is also responsible for it. In case of Ultra Violet features embedded in cheques they were embedded in good manner. But in some cheques the fluorescent ink spread on the other area of cheque also. It creates confusion during examination that whether it is security feature or not? So proper care should be taken while preparation of cheques. While analysis it comes to know that cheques from most of the banks shows some variations in time interval. Sometime there is change in design such as design of VOID pantograph, printing information, etc. or sometime there is change in any security feature. In some cheques the micro lettering is present in form of lines on which the amount is written and also the box in which account number & new rupee symbol (₹) is present. In some cheques only dotted line is present and no micro letters are present. So it is necessary to standardize these format and it is necessary to maintain the consistency of these security features throughout the time. The presence of VOID pantograph was observed during examination which is also one of the important security feature. Cheques from different banks have different designs of VOID pantograph. There is no standard dimensions and format of VOID pantograph which to be incorporated in cheques. Even cheques from same bank shows difference between VOID pantograph in time interval. So it is necessary to modify the CTS-2010 guidelines in such a way that the cheques should be printed in such standard formats that they are difficult to be forged. While printing the currency the care which is taken should be also taken while printing genuine cheques because in the present world of banking and online transactions cheques plays an important role in commercial dealings. It is difficult to prepare forged cheque but the cheque forgery include signature forgery or disguising on cheque, cheque washing, etc. were noted down in past days. So it is important to reduce variations in genuine cheques and try to prepare genuine cheques in more standardized format with more care should take while printing process. According to the CTS-2010 guidelines the security features incorporated in cheques are classified into mandatory features and desirable features. If we compare it with currency the major difference, we come to find that all the security features incorporate in currency are mandatory and also they are printed with more care. So the currency is more secure whereas security features in cheques are not all mandatory. So if the CTS-2010 guidelines modify in such a way that all the security features incorporated in cheques are mandatory then they will be more secure as compare to present cheques and difficult to be forged. Also the incorporation of omron features i.e. anti-copying features can be done in cheques which can prevent the genuine cheques from forgery.

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