Ultraviolet Cheque Security

Understanding a New Era of Automated Fraud Prevention

DIGITAL CHECK®

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Introduction

The demise of the cheque has been predicted for years: As a physical, manual payment instrument, it stands as something of an anachronism in the face of automation and e-commerce. But modern processing techniques have helped bring the cheque up to speed and make it more secure. For the billions of cheques still written each year - amounting to trillions of dollars' worth of payments - ultraviolet (UV) validation is both a practical and a cost-effective method of preventing losses, and represents the next step in the ongoing security battle against fraud.

The advent of scanners and software capable of reading UV in an automated fashion have opened up exciting new possibilities. Within the next 1-2 years, we expect to see a surge in UV adoption as those countries currently introducing automation technology gain expertise and report success in fraud prevention. As time goes on and the added cost of the equipment becomes negligible, UV will likely become a standard part of the cheque clearing process wherever truncation and imaging are used.

Executive Summary

Recent advances in imaging technology have turned ultraviolet (UV) printing into an increasingly popular cheque security feature in which the cheque scanning hardware supports the capture of UV print. While its value as a fraud-prevention tool is a fairly straightforward concept to embrace, actual implementation of UV technologies has varied greatly from region to region, as has the speed of adoption overall.

In an effort to promote greater understanding of the emerging trends and best practices for using UV as a cheque fraud-prevention tool, Digital Check conducted a broad range of in-depth interviews with industry experts around the world in late 2012. These interviews covered the full range of a cheque's lifecycle, from UV ink manufacturing all the way through the fraud-recognition software used in the clearing process. The picture that emerged was one of a technology that possesses tremendous potential when used properly, but which also requires a degree of skill and focus to correctly implement.

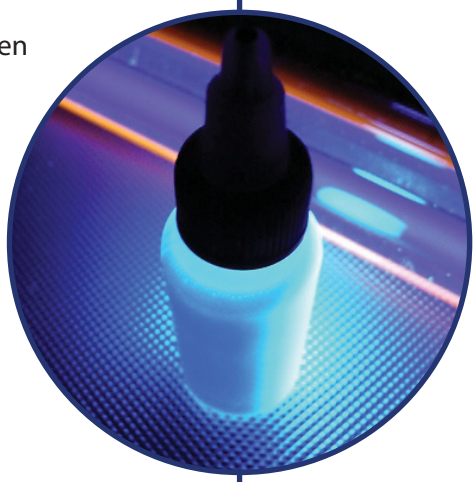
A few countries such as Malaysia, India and Nigeria have begun developing the discipline necessary to build a functional UV cheque authentication process. However, the global trend is that UV is still a "work in progress" for most of the early-adopting nations, while many other countries are waiting for various technical challenges to be resolved before they adopt. Much depends on the interest and persistence of a country's banking regulators, as well as on the coordination of the major banks themselves. Our goal in this paper is to develop a clear roadmap to successful UV cheque validation by identifying the main pressure points in the process and recommending best practices for creating a sustainable system.

The State of UV Cheque Capture

Invisible inks have been used to print security features on many types of documents - including cheques - for decades. The obvious benefit of such features is that they help to detect and discourage fraud: Many would-be cheque forgers fail because they are simply unaware that such items are present; others are deterred by the difficulty of printing a convincing fake. Ultraviolet ink in particular has become increasingly popular as a security feature because of its widespread availability and the ease of inspection - a document's authenticity can be checked by anyone with a simple UV lamp or flashlight.

However, a major limitation of UV ink until recently was the lack of an efficient way to validate it automatically by machine. Though the invisible features remained an effective fraud-prevention tool, they also required that each cheque be inspected manually - which grew problematic as the rest of the cheque clearing process became automated. With less time to handle each item, large-scale screening became impractical, with the end result that many banks ended up inspecting UV on only a fraction of the cheques they accepted.

Only within the past two to three years have compact, cost-effective UV cameras been developed that are suitable for use in cheque imaging devices, and the result has been a new wave of innovation in cheque and document security. While the newest version of UV security is still in the deployment phase around the world, there is strong evidence to indicate that it could prevent billions in fraud losses per year when fully developed.



In a broad sense, enthusiasm for ultraviolet validation can be correlated with the pervasiveness of cheque fraud in a given country or region. Several factors can help determine how likely a nation's banking system is to benefit from UV:

Prevalence of Personal Cheques

In some countries like India, Malaysia, Nigeria and Chile, the use of personal cheques is widespread; in others like Mexico and parts of the EU, cheques are restricted mainly to business and government. Those countries with prevalent use of personal cheques naturally tend to process more items overall than their counterparts, for a higher total value - therefore, each percentage point reduction in fraud translates into a more meaningful cost savings for their respective banking systems. Many of the countries pursuing an aggressive course of UV adoption also experience heavy volume usage of personal cheques.

Lifecycle of Cheques in the Banking System

Is the cheque an essential part of the country's transaction landscape, or an outgoing form of payment? It's no secret that electronic payments are replacing paper processes in many parts of the world, including some where government agencies are actively encouraging that process - in certain EU countries, for instance, cheques no longer exist at all. At the other end of the spectrum, some of the world's least developed countries have bypassed the cheque entirely: In many parts of Africa, few people have (or have ever had) access to a bank account, but mobile phones have become universal, leading to the natural evolution of a paper-free payments system. It is the remaining part of the world - that in which the use of cheques is well-established and either remaining steady or declining gradually - where UV stands to benefit the banking system.

Presence of Other Automated Clearing Functions

In virtually all of the countries utilizing UV cheque scanning today, adoption was at least partly driven by the electronification of the cheque clearing process in general. Specifically, the presence of cheque truncation or a close equivalent encourages the establishment of more reliable automated security.

In simplest terms, speeding up the clearing process shortens the length of time that banks have to identify fraudulent cheques, and places tremendous pressure on the accepting bank to detect forgeries on Day One. Regions where truncation is relatively new are prime territory for the introduction of new validation measures, including UV.

The Number of Financial Institutions in the Country

More banks generally means more customers and more cheques. However, it also makes coordination more complicated, and implementation may take longer as a result. It is also worth noting that print quality of cheques may vary significantly.

Conversely, when very large financial institutions are present, it is not uncommon to encounter several different styles of cheques and UV patterns within the same bank - another factor that must be accounted for when considering standardization.

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Potential Impact of UV Validation

Projecting Impact on Fraud and Forgery

Because UV is still in the early stages of implementation, hard figures on fraud prevention are difficult to come by - there is no "magic number" on how much cheque fraud should be eliminated by adding it as a validation step. However, some sense of the impact of modernization in general can be felt by examining the incidence of fraud in various parts of the world.

In a comprehensive study by the American Bankers' Association in 2009, financial institutions in the United States reported just over $1 billion in losses from cheque fraud on $31.6 trillion in paid checks, representing a loss rate of 0.00003%. However, total attempted cheque fraud was more than $11.3 billion - meaning over 90% of fraud was detected before any losses occurred. A UK study in 2011 reported cheque fraud losses of £34.7 million on approximately £350 million in attempted fraud. Overall fraud figures for other countries using tightly-controlled electronic clearing systems, such as Australia and Singapore, show similarly low percentages of fraud, on the order of <0.0001% by total dollar amount.

Contrast this with the situation in Nigeria, a country with a history of fraud problems. In 2010 the Nigerian Deposit Insurance Corporation (NDIC) estimated total bank fraud losses at N11.68 billion on N22 billion attempted, a loss rate of over 53%. The loss rates in 2009 and 2008 were 18.29% and 32.78%, respectively. While the NDIC's statistics do not discriminate between cheque fraud specifically and bank fraud overall, there exists a clear correlation between the use of advanced electronic clearing techniques and a reduction in successful fraud attempts. Not surprisingly, Nigeria is among the countries that recently began efforts to introduce UV to the cheque clearing process.

Since ultraviolet cheque scanning is a recent development, data are scarce regarding how much of a reduction in fraud may be expected when UV is introduced as a security feature. However, many countries have introduced such features on their banknotes over the past decade, providing insight into the effectiveness of advanced printing techniques in fraud deterrence.

Example: Currency Counterfeiting in North America

In 2004, the United States added a UV microstrip to its currency for the first time, along with a series of other changes designed to make counterfeiting more difficult. In subsequent years, the increase in the amount of counterfeit money removed from circulation was noticeable:

Counterfeit Bills Seized	
2005	$61,000,000
2007	$62,000,000
2008	$103,000,000
2009	$132,000,000
2011	$261,000,000

Source: United States Secret Service

Canada also introduced redesigned banknotes from 2001-2004 to combat a rise in counterfeiting; features in the new notes included watermarks, holograms, and enhanced UV security. Reports from 2004 found a rate of 4.7 counterfeit bills per 10,000 among the older-style bills, or more than 550,000 fake notes in total. After the introduction of the new features, the counterfeit rate dropped dramatically:

Counterfeit Bills Passed	
2004	552,980
2005	402,303
2006	287,088
2007	141,502
2008	107,689
2009	66,696
2010	53,536

Source: Royal Canadian Mounted Police

Field testing has shown that automated verification can cut the time needed to inspect a UV cheque to less than a second, compared with up to 30 seconds for manual methods.

Key differences - such as the presence of other security features in addition to UV, and differing inspection and processing methods - make a one-to-one comparison impossible between cheques and banknotes. However, in light of the strong evidence supporting UV's effectiveness at fraud reduction, we can predict with confidence that UV security features, *when introduced as part of a comprehensive anti-fraud initiative,* should reduce the incidence of cheque fraud and forgery by as much as 50%.

Impact on Processing Time

As mentioned in the introduction, a major limitation of UV security features until recently was the lack of an effective way to read them by machine. But with the appearance of compact UV cameras capable of fitting into a cheque scanner or similar reading device, that obstacle has been removed. Field testing in locations from South America to Southeast Asia has shown that automated verification can cut the time needed to inspect a UV cheque to less than a second, compared with up to 30 seconds for manual methods.

The practical implication of this advance is that banks can now inspect ALL cheques for UV, instead of only a small fraction. With millions or billions of cheques a day passing through national clearing systems, typical practice with manual UV inspection was to inspect only those cheques with the highest values. Apart from detecting high-value fraud more effectively, automated UV scanning will also help banks intercept many lower-value cheques that may otherwise have gone undetected.

Computer assisted verification can be accomplished by visually inspecting normal and UV scanned images on a display, and flagging suspect cheques. Moreover, machine-readable UV allows greater precision, as well as the use of features not readable by the human eye, such as bar codes and numerical algorithms that add a new level of security.

Impact on Cost

The primary difference in raw component cost between a UV and non-UV cheque scanner is the price of a specialized UV camera. As of early 2013, a UV camera costs approximately five times more than a standard optical camera - raising the overall price of a mid-sized scanner by roughly 30%.

Since the typical replacement cycle for computer hardware tends to be 5-6 years, we expect that price parity will be achieved by the next time most banks go through their next equipment upgrade. Until that time, any bank seeking to replace its scanners should consider purchasing UV-capable models if it expects UV security to be introduced in its country before the end of 2017 - the point at which the 30% savings from buying standard hardware today would be offset by the shortened lifespan due to forced replacement.

It should be noted that the primary reason for the price difference between UV and traditional cameras is production scale; as more of the UV versions are produced, we expect their price to drop. Exactly how much remains to be seen; however, it is safe to assume that as the adoption of UV cheque scanning increases worldwide, we can expect the cost of those specialized components to become somewhat closer to that of their traditional counterparts.

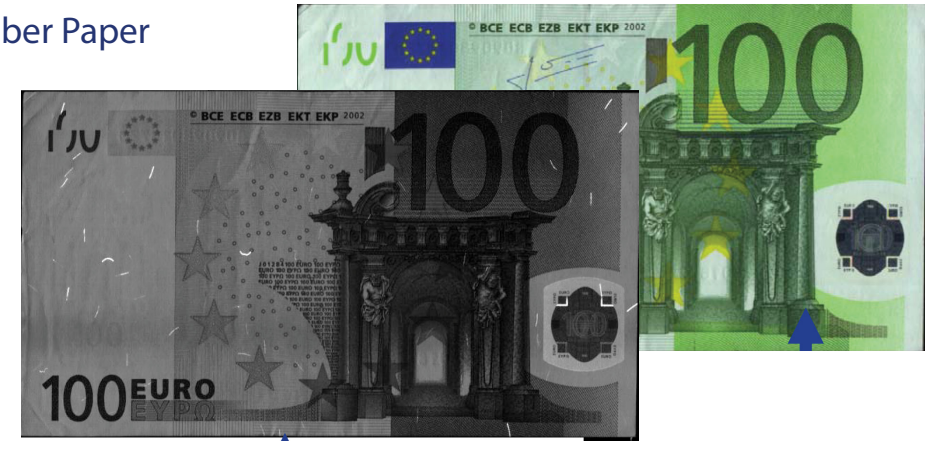
Types and Effectiveness of UV Features

As with visible-light printing, there are several standard ways of authenticating a document with UV ink. Some are designed specifically to detect fraud; others are more effective against forgery. Below are examples of the more common methods of UV cheque verification.

UV Scatter Spray

One of the most basic ultraviolet security features. Spots of UV ink are spattered randomly on the cheque. Validation involves simply determining whether UV is present or not. Will thwart the least sophisticated forgers (those who do not know UV is present on the cheque at all), but is relatively simple to reproduce. May also have some effectiveness in spotting chemically or mechanically altered fields.
Advantages: Low cost, low production difficulty
Disadvantages: Among the easiest features to replicate on a fake cheque

UV Fiber Paper



Ultraviolet fibers are imbedded within the paper itself, similar to techniques used in currency paper around the world. Like scatter spray, validation is a simple true/false test for the presence of UV. However, UV fibers offer an added degree of protection because they cannot be reprinted on a fake document with UV ink - the forger must have access to UV fiber paper, which is much more difficult to obtain.

Advantages: Difficult to replicate
Disadvantages: Validation tests are still relatively unsophisticated. Legitimate cheques may remain vulnerable to manipulation if fiber is the only feature used.

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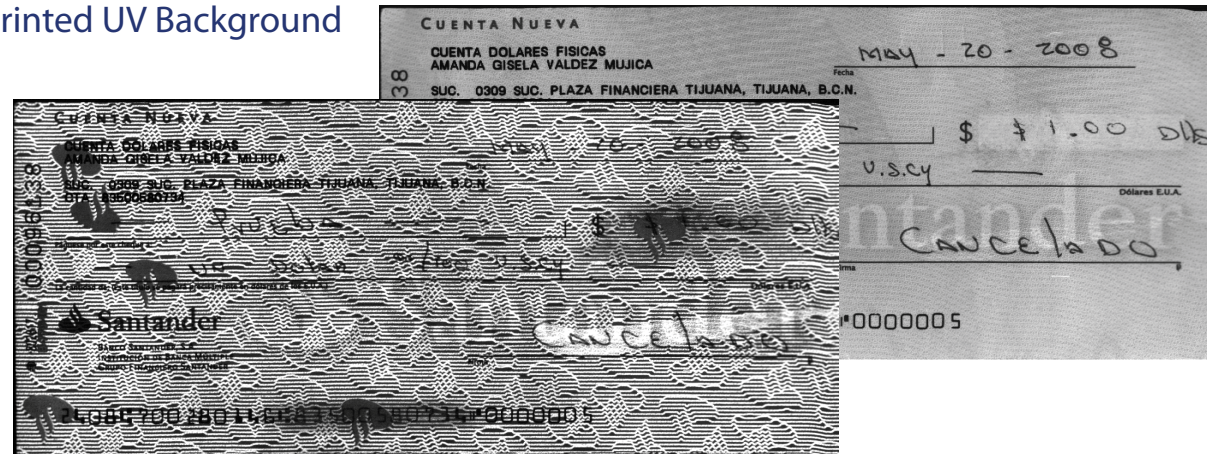
Printed UV Background



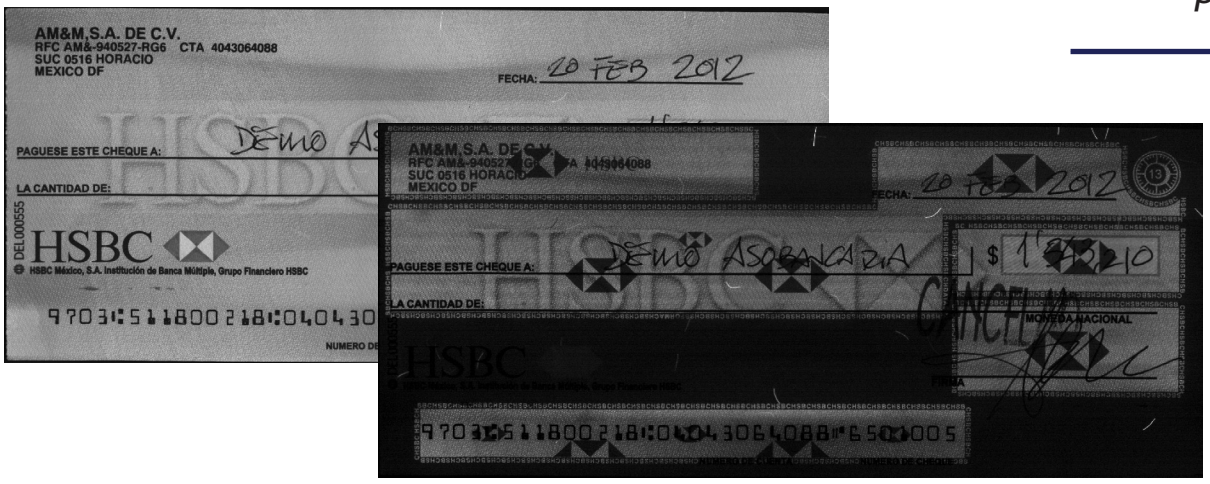
A pattern is printed in UV ink over part or all of the cheque. This may be a simple pattern such as stripes or waves, or a more complex design involving logos and small print. Typically designed to be destructible, so that the background will show a large "hole" or smudge if part of the visible-light writing on the cheque is erased. Key areas of the cheque such as the amount and payee fields are the ones most commonly protected. Some validation software solutions can also evaluate the accuracy of simple patterns such as lines and waves, though more complex patterns remain difficult.

Advantages: Relatively inexpensive and efficient to produce. Provides excellent protection against chemical or mechanical alteration of cheques.

Disadvantages: Difficult to duplicate, but not completely foolproof. Difficult to standardize for machine-readability at the national level, so security mostly limited to thwarting alterations.

Since each bank typically prints its own logo on its cheques, testing other banks' cheques becomes problematic unless excellent coordination is present.

Printed UV Logo

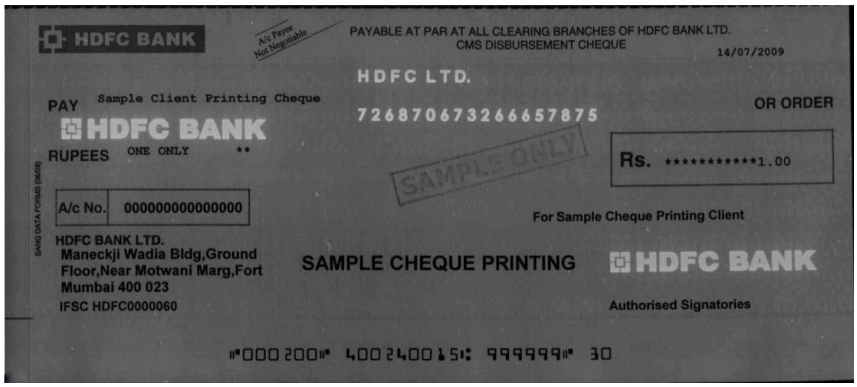


A logo (usually that of the issuing bank) is printed across sensitive areas of the cheque or in specified locations. Provides similar protection to a UV background against alterations; makes outright forgeries difficult though not impossible. Since each bank typically prints its own logo on its cheques, testing other banks' cheques becomes problematic unless excellent coordination is present.

Advantages: Relatively inexpensive and efficient. Provides a measure of protection against both fraud and forgery if implemented correctly.

Disadvantages: Full effectiveness requires a level of standardization or cooperation between banks, which is generally not yet present.

UV Serial Number/Algorithm



A sequence of numbers is printed with UV ink at a specific location on the cheque. The numbers may contain coded information about the cheque, similar to the MICR line, or may be based on an algorithm known only to the issuing bank. Offers very strong protection from outright forgeries, as fraudsters will have no way of producing valid numbers.
Advantages: Nearly impossible to replicate correctly on a forged cheque.
Disadvantages: Added cost and complexity. If used alone, legitimate cheques may still be vulnerable to alteration. Must be machine-read to be of any use - with manual inspection methods, incorrect numbers can still fool the operator.

UV serial numbers and 2D bar codes must be machine-readable to be effective. With manual inspection, incorrect security information can still fool the operator.

2D Bar Code

Similar in concept to the UV serial number, with the added enhancement that the cheque's unique information is hidden within a graphic unreadable to the human eye. Among the strongest available measures of protection against forgery.
Advantages: Nearly impossible to replicate correctly on a forged cheque.
Disadvantages: Cost and complexity. If used alone, legitimate cheques may still be vulnerable to alteration. Must be machine-read to be of any use - with manual inspection methods, incorrect numbers can still fool the operator. It also requires high-quality UV printing.

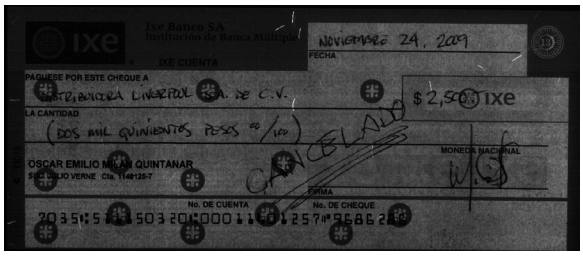
Overcoming Barriers to UV Adoption

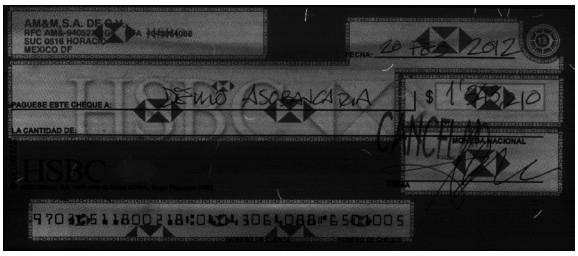
Standardization Issues

All of the experts that Digital Check interviewed cited standardization - and specifically, the standardization of ultraviolet security features at the national level - as far and away the most important requirement for developing a successful UV cheque validation program. However, few if any countries have yet achieved the necessary level of discipline for all cheques to be properly validated by machine. If no standard formatting is in place, a high percentage of cheques will require manual inspection, or will not be validated at all, greatly diminishing the effectiveness of the system. Therefore, standardization constitutes the top technical obstacle for any country wishing to incorporate UV security.

In the examples below, UV logos are present on both of these cheques from Mexico, but varying size and positioning can make it difficult for other banks to validate them by machine.

It is essential that any set of UV standards issued is precise, and that it is enacted at the national level, rather than the individual-bank level, to allow cross-validation. An example of this practice's importance can be drawn from India, where the recent introduction of UV came with a well-intended requirement that banks include a logo as a security feature. Naturally, the tendency was for each bank to print its own logo in strategic locations - but without precise specifications for the logos' size and positioning, it was difficult or impossible for accepting banks to machine-validate the authenticity of any cheques but their own. It is important to note that the logos remained useful against tampering, so not all of the benefits of UV were lost. However, its effectiveness in determining a cheque's authenticity was diminished.





It is important to note that, in many countries, the policymakers who introduce UV security are not themselves technical experts on cheque imaging. When this is the case, it is important that financial institutions - as well as other firms with expertise in imaging hardware and software - be involved early on in coordinating standards that will ensure machine readability by all banks in the country. In some regions, strong banking industry associations already exist and self-regulate to an extent; in others, various national standards institutes may be present. When available, such organizations can be instrumental in achieving a desirable outcome. In countries with fewer financial institutions and no strong industry associations, the onus may be on the larger banks themselves to open dialogue with regulators, or to come to an agreement with each other on standardization.

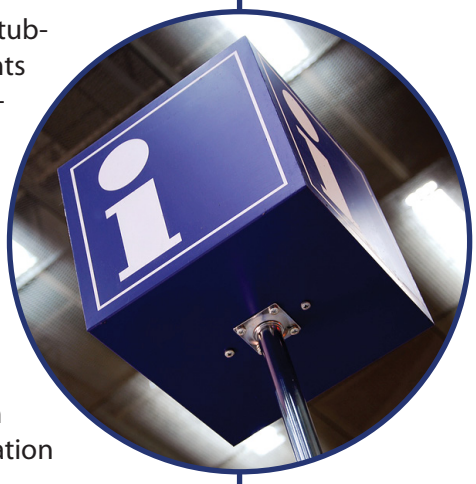
For a full list of standardization practices that we recommend, please see the Best Practices section toward the end of this document.

Persistence of Legacy (non-UV) Cheques

A secondary obstacle to automation is the existence of large pre-existing cheque stocks, and the tendency of consumers to hoard their supplies of cheques and other financial instruments even after new standards have been introduced. Without an incentive to upgrade, most bank customers will continue to use non-UV cheques until their supplies are exhausted - resulting in a likely 1-2 year period of widespread nonconformity, with occasional non-UV cheques appearing for up to 10 years.

Cost is the primary reason why old cheques will persist: If consumers are the ones who bear the cost of replacing them, very few will do so until they must. If financial institutions were to offer free UV replacements, the expected uptake would be much higher – possibly great enough to allow automation within months rather than years. In many cases, financial institutions could likely justify the cost of the free cheques by the offsetting reduction in fraud. However, such a replacement program would need to be coordinated across the entire banking industry within a country in order to be effective.

A residual stream of legacy non-UV cheques could still be expected from the most stubborn consumers: those who held on to their old cheques even after free replacements were offered. Eliminating this final source of nonconformity would require a consensus within the industry – or intervention by regulators – to establish a "hard stop" date after which non-UV cheques would no longer be accepted. It is possible, however, that this source of error would not be enough to significantly affect the automated validation process.



Expertise with UV Technology

Even with strong regulations and standardization in place, a degree of experience in certain areas should be established in order to maximize effectiveness of a UV validation system. These elements include:

- A reliable source(s) of UV cheques with consistent printing
- Total penetration of UV scanning equipment
- Training of operators

None of these should be confused with "critical obstacles" – e.g., once adoption is decided upon, these issues will almost certainly be resolved with time. However, the consensus of our panelists was that even in the case of a perfect implementation, it may take at least a year to realize the full security benefits of UV.

Technical/Implementation Decisions

Beyond the big-picture issues in UV validation lie many practical questions about specifications and image handling that can ultimately help or hinder the technology's effectiveness (and cost). High among these decisions are:

- File formats and sizes for cheque images
- What information is exchanged in the clearing process and/or saved offline
- Software workarounds for standardization problems
- Readability for machines versus human operators
- Costs and benefits of difficult security features

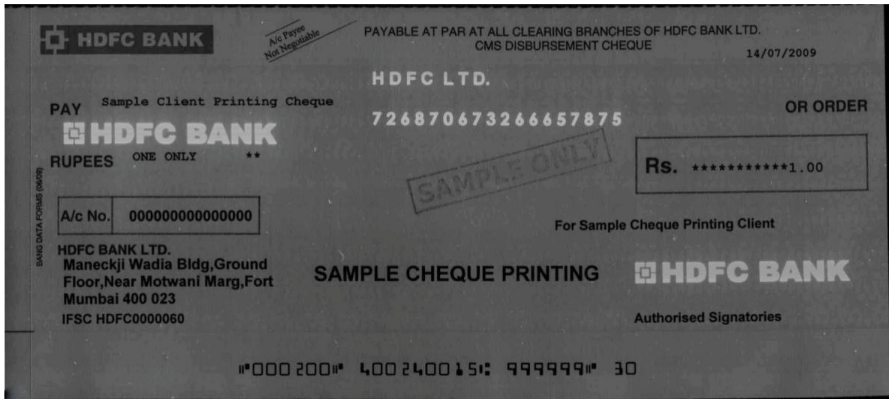
Some of these issues may be purely preferential decisions, while others may have significant long-term impact depending on the situation within an individual country or financial institution.

File Formats

There exist three preferred formats for capturing UV features within cheque images: grayscale, bi-tonal and reverse bi-tonal. Many cheque scanners are capable of capturing images in whichever format the operator chooses, so any of the major options should not restrict hardware options.

A grayscale cheque image allows for the greatest amount of detail, but also creates the largest file size. Bi-tonal (black and white only) images are usually easiest for human operators to read.

Grayscale image

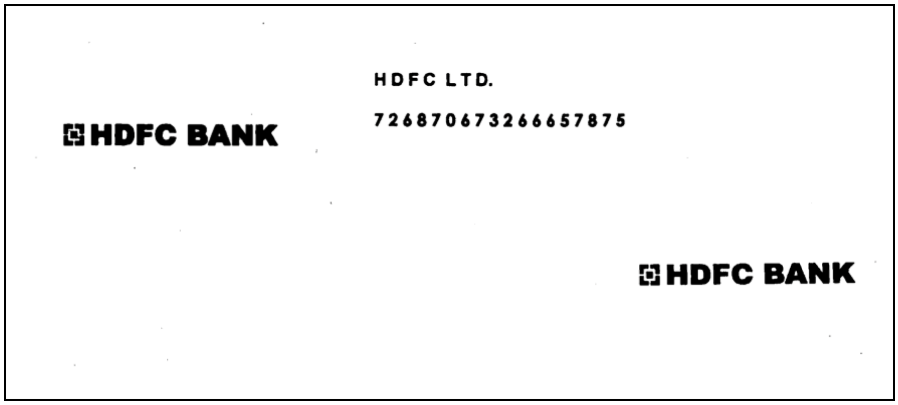


Captures the full-spectrum profile of a cheque. Allows greater detail, including intensity and precise location of UV compared to optical features. Can be subject to interference if optical-light background is too similar in intensity to UV. Has largest file size of the three major formats.

Bi-tonal image

Captures UV features only; UV is displayed as white on a black background. Intensity is not recorded; each pixel is either white if any UV is present, or black if no UV is present. Tends to be easy for human operators to spot discrepancies when a cheque is flagged as suspicious. File size is smaller than grayscale but larger than reverse bi-tonal.

Reverse Bi-tonal image



Captures UV features only; UV is displayed as black on a white background. As with standard bi-tonal, each pixel is a true/false test for the presence of UV, and intensity is not recorded. Is the easiest for human operators to spot discrepancies when a cheque is flagged. Has the smallest file size.

Ideally, the image format will be considered at the same time that standardization of UV features is decided in a country. Grayscales, for example, might offer the most options for combined optical-UV features and are best for automatic validation routines; however, a bi-tonal UV image may be best if a large UV background overlaps with heavy visible-light printing.

Human eyes tend to discern features within bi-tonal images more easily than other image types. However, any visible-spectrum features are discarded in a bi-tonal cheque image.

Image Exchange and Archiving

Currently, the only certain step in the life of a UV cheque image is that the accepting bank will use it to verify authenticity before the cheque enters the clearing process. What happens after that is largely up to the bank that captured the image. As of December 2012, no countries using UV validation require UV images to be exchanged as part of the cheque clearing process, which we believe is largely due to the significantly higher data bandwidth that would require if it were done for every cheque. Instead, UV images are used for initial validation and either discarded or archived in the financial institution's own database.

The argument for exchanging images is that it would theoretically provide a double layer of security; however, in an automated, standardized system, validation techniques should be so similar that a second validation by the on-us bank would be merely redundant. A more compelling argument can be made for each bank retaining UV images in its own offline archive, particularly in cases where it may help detect patterns of serial fraud. We can envision a time in which the UV images of suspect cheques are sent to a national database that can be accessed by investigators; however, at present, no such system exists.

Software Workarounds for Standardization

In many countries, there is no guarantee that the loopholes in UV cheque standards will ever be completely addressed – so banks and software vendors have developed ways to solve the problem on their own. For example, when the use of a UV logo is required but guidelines are not specific, some companies have developed software that validates these features based on a database of known logos in that region. Others possess image-recognition technology capable of identifying a particular logo or pattern regardless of its location on the cheque.

These types of applications, in theory, can vastly improve the operability of a UV validation system, filling in the missing steps that will allow machine readability. There can be small security trade-offs: If, for example, a feature can be identified regardless of position, then precise positioning becomes less effective as a validation tool. However, it is our view that on balance these advances solve far more problems than they cause, often acting as the standard where none exists (and might otherwise not exist for years). We foresee that as more countries adopt UV validation – each one with its own strengths, weaknesses and nuances – augmentation by third-party software will play a key role in closing the gaps to create functional validation systems.

Readability for Machines vs. Human Operators

While the goal of UV cheque scanning is an automated validation process, in most cases it will still be a human operator who makes the final decision on questionable items.The most preferential outcome for a bank is that a fraudulent cheque be detected in real time at the branch, so that the suspicious item never enters the clearing process. However, given the nature of daily operations and the various forms of UV security, it is inevitable that some inspections will not occur instantaneously.

In the case of advanced security features such as bar codes and numerical algorithms, machine validation will be absolute and the operators' decisions straightforward. When "traditional" UV features such as backgrounds, logos and fibers are present, a visual inspection is necessary to confirm or override the machine's decision to flag an item as suspicious. Generally, the more of these visual features are present, the greater the importance of maintaining a well-trained an experienced staff of operators; and therefore, the more beneficial it will be to validate suspicious items in a central office.

Ideally, at least two feature sets should be used on each cheque: one that permits total machine validation, and one that lends itself to visual inspection.

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Quality Control of the Print Process

An oft-overlooked facet of UV cheque authentication is that its usefulness in preventing fraud is only as good as the quality of the cheque itself. The printers and ink manufacturers that we interviewed for this paper stressed that working with ultraviolet ink is not at all the same as printing in the traditional visible spectrum; it can take several months to learn how to consistently produce designs to uniform specifications. Certain problems associated with printing include:

- **Improperly positioned elements:** Logos, serial numbers or codes can be mistakenly flagged as incorrect, particularly if near dark print or document edges.

- **Incorrect intensity:** UV elements can be flagged as non-present or altered.

- **Incorrect wavelength:** If the UV ink used does not fall inside scanning specifications, it may appear faintly or not at all in an image.

In addition to image quality issues, each of the above situations creates the additional problem of making professionally printed cheques less distinguishable from forgeries made on lower-grade equipment.

Many banks considering UV will recall similar experiences with imprecise MICR printing (including cases where some printers reportedly reduced the magnetic content of their ink by as much as 60% as a cost-cutting measure). It is therefore advisable for regulators and financial institutions alike to pre-qualify their cheque providers. Particularly in the developing world, many banks may find that their current vendors do not have experience with UV, in which case it may be necessary to allow additional time for training, or to consider a separate source for UV cheques.

Best Practices
For Successful Implementation of UV Validation

Since automated UV scanning is relatively new, best practices can be separated into two groups: general guidelines for introducing a successful system at the national level, and specific protocols for the bank-operations level.

At the National Level

- **Precise specifications** (size, position, etc.) for machine-readable features must be established to allow any bank to validate cheques from any other bank.

- At least **two types of features should be standard:** One feature set to protect specifically against alteration, and one set to prevent forgeries. (Examples: Logos + UV Fibers, UV background + 2D bar code, etc.)

- Ideally, at least **one feature should be completely machine-verifiable,** such as a numeric algorithm or bar code.

- Printers of UV cheques should undergo **a training and/or screening process** to ensure that they possess the necessary expertise to produce uniform, machine-readable documents to specifications.

- **A standard file format** should be decided upon.

- **A date should be selected** for the phase-out of old (non-UV) cheques, and a program enacted to replace or invalidate customers' stock of such legacy cheques.

At least two types of features should be standard: One feature set specifically designed to protect against alteration, and one set designed specifically to prevent forgeries.

At the Bank Operations Level

- Beginning preparations **1-2 years in advance** will allow ample time for equipment to be upgraded as part of the natural replacement process, as well as time for adequate operator training.

- Banks should maintain **an archive of UV images** of cleared cheques for at least several months.

- At least **some validation should be performed at the branch level** in order to reduce the number of fraudulent cheques that must be removed from the clearing system on Day Two.

- **Quality control measures** should be implemented to ensure that UV cheques meet standards; cheques should be purchased from a certified or otherwise qualified printer.

- **A phased approach to implementation** is highly recommended. Ideally, cheque inspection will first be performed manually, followed by a period of manual inspections with machine assistance, followed by full automation. This will allow operators time to become familiar with the various UV features in use, as well as how to recognize manipulation and fakes quickly in a full-speed production environment.

Best Practices

Characteristics of a Successful UV Cheque

A question we have been asked frequently when discussing UV is: Given all the different types of features and the different ways of using them, what *DOES* an ideal UV cheque look like? Here is an example with some helpful guidelines.

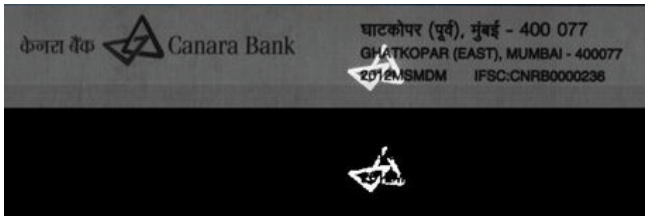
UV serial number to prevent forgeries
- Away from any heavy visible printing
- Away from writing areas

Clearly identifiable UV pattern to protect against manipulation
- Covers entire writing area
- Does not mix with other UV features
- Easily identifiable by machine

Non-sensitive areas free of UV to reduce potential for confusion and misreads

Clearly visible UV logo
- Same size on all cheques
- Precisely positioned on all cheques
- Away from heavy printing
- Away from writing areas

Example: Printing UV features in areas with black ink can cause machines to misread them!



Conclusions

Payments in the 21st century have become increasingly electronic and automated, and cheque processing is no exception. Along with these advances have come new perils: Machines have sped up the clearing process tremendously, but banks must also find security techniques that are much faster without sacrificing accuracy. The availability of machine-readable UV features represents a practical fraud-prevention method that keeps pace with the changing payments landscape.

To be sure, UV cheque security is still an emerging technology, but one that we believe is gaining momentum worldwide. In 2013 and beyond, we expect to see numerous success stories emerge as banks and countries employ UV and begin to quantify just how much it can save from a loss-prevention perspective. With the cost of equipment also likely to decrease in coming years, we expect that UV will soon become the norm in countries where cheque use remains widespread.

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