The Gold Standard for Mobile Check Deposit

The Only Viable Approach for Implementing Mobile Remote Deposit Capture

Technology and Business Considerations

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August 2010

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1 Executive Summary

THE OPPORTUNITY

The explosive growth in consumer and business adoption of mobile banking services presents new opportunities and challenges for financial institutions (FIs). Most recently, mobile check deposit services have begun to alter the mobile banking landscape. Mobile Remote Deposit Capture (Mobile RDC) offers consumers and businesses the convenience of easily depositing checks from anywhere. Some of the benefits financial institutions will realize from Mobile RDC are the ability to offer attractive new customer services, increased profits, enhanced customer loyalty, and significant cost savings. The most important goal in offering customers a new mobile service is creating an outstanding user experience while driving operational efficiencies. This paper discusses the best in class practices in Mobile RDC which Mitek Systems refers to as the Gold Standard.

THE NEED FOR NEW TECHNOLOGIES

To achieve these benefits, Mobile RDC must first address a new set of technical challenges that are completely unaddressed by traditional check processing technologies. Mobile RDC requires a new set of technologies, know-how and domain expertise. That is no trivial task. Because check images submitted via camera-equipped smartphones can be much harder to read and verify than images captured with traditional check scanners, new solutions are required to fully address the image processing complexities involved in accurately and efficiently processing mobile deposits.

THE CHALLENGE OF DOING IT RIGHT

While overcoming these challenges, mobile deposit technology must simultaneously offer a superior user experience while maintaining high performance standards for Check 21 processing. It must deliver high security and accuracy, provide real-time guidance to the user, and more. Users will not tolerate services which would require them to take a picture multiple times for each deposit! Banks will not tolerate lack of security, false acceptance, or insufficient audit trails. This white paper explains the challenges of doing mobile check deposit correctly and efficiently.

THE COST OF FAILURE IS TOO HIGH

The cost of failing to address the challenges outlined here will result in avoidable costs of expensive manual intervention, reduction in customer satisfaction and loyalty, loss of revenue, increase in fraud, and damage to the bank's brand as a provider of quality services. Mitek estimates that banks will invest up to $150 per Mobile deposit user in marketing expenses to drive consumer adoption. This high level of expense makes it necessary to ensure every customer who tries Mobile Phone deposit will have an outstanding user experience on the very first try. WARNING! Using existing scanner technology which was not developed for color mobile photos will result in automated check acceptance rates of less than 50% and first time customer attrition of at least 20%. This means that for every 100 customers who sign up and use the solution, 20 of them will not use it again, and will likely share their negative experience!

EXPERTS NEEDED: THE GOLD STANDARD FOR MOBILE DEPOSIT

To derive potential benefits while avoiding risks and costs, mobile check deposit requires a higher standard of processing technology than ever before. Make sure your rollout plan includes a solution that implements this Gold Standard to assure a successful deployment:

- End-to-end security
- Accuracy
- Ease of use
- Scalability and integration
- Support for many smartphone platforms
- Adherence to industry standards
- Mobile check imaging test suite

2 The Opportunity: Growth of Mobile Check Deposit

In rapidly increasing numbers, people use their phones for more than conversation: they use it to access Web sites, send email and text messages, and more. Smartphone users, i.e. owners of BlackBerrys, iPhones, and Android phones make up the segment that is the fastest growing. A phone is considered a smartphone if it allows third-party developers to create and install software other than what the phone manufacturer or network carrier provided. The explosive growth of such third-party applications is a current phenomenon, with the Apple Store currently hosting around 200,000 applications, and other platforms making great advances in an effort to remain competitive.

Smartphones are even replacing desktop and laptop computers for many people, especially while traveling or just away from home or office. As a result, behaviors are changing and consumer expectations are increasingly moving in the direction of having their information at their fingertips anytime.

As of early 2010, one quarter of all phones are smartphones, and that ratio is expected to double by 2014. In absolute numbers: there are 45 million U.S. smartphone users today, increasing to 114 million by 2014. Many consumers use mobile banking regularly, even daily, and almost half of current smartphone users say they are "interested" or "very interested" in using Mobile RDC, according to research published by Javelin Strategy & Research.

Given these numbers and trends, banks are offering new mobile services to their customers. Those services will help them retain customers by offering increased convenience and better service at lower cost.

According to a recent April 2010 report[1] by Javelin Strategy & Research, “one in four consumers desire mobile remote deposit capture,” and “the business case for mobile remote deposit capture is much stronger for the small business market.” The report goes on to cite high desire for this service amongst self-employed and small business owners, iPhone, mobile banking, and smartphone users. And since the bulk of business transactions are made by check, mobile deposit is extremely attractive to businesses. This is why Mobile RDC will soon be added to the mobile banking offerings of most banks, regardless of size, and within a few years will be a standard offering no bank wishing to stay competitive can be without.

[1] Javelin Strategy & Research, April 2010, Mobile Remote Deposit Capture: With Consumer Desire Strong, Smartphone Adoption and Security Key to Financial Institution Appeal

3 Mobile Imaging Technologies

Mobile check deposit requires new ways of analyzing and preparing photographs for Check 21 processing, as well as extreme recognition to achieve good data accuracy. Mobile images can be less than perfect, especially when compared to those created with check scanners.

In traditional check processing with dedicated check scanners, a two-dimensional image of a check can easily be captured because there are no other objects in the image, no confounding issues of lighting, contrast, shadows and geometrical distortions, lens quality or shaking (e.g. from unsteady hands holding the camera). The industry refers to this as a *constrained environment*.

By contrast, mobile images of checks suffer from an almost completely *unconstrained* environment with unknown distortions of geometry and strong shadows, just to name a few. What makes the problem much tougher than RDC from check scanners in places such as ATMs is the fact that the check within the mobile photograph is an object in 3-D space. That's why mobile capture requires a new domain of extreme image recognition science to be successful.

There are significant and complex challenges:

- It's hard to find the check.
- It's hard to de-warp the check image.
- It's hard to remove shadows.
- It's hard to read the MICR.
- It's hard to read the correct amount.
- It's hard to do meaningful alerts.

3.1 It's Hard to Find the Check

A key element and technological challenge to processing a mobile check image is to first find the check in the 3-D photograph.

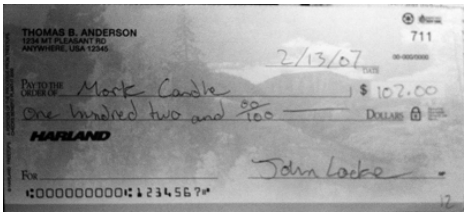
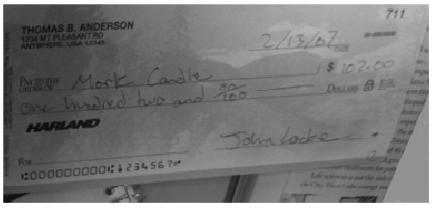
One approach to help find the check is to insist that the background is noticeably darker than the check, making the check "stand out." Another way is the use of a viewfinder window, which restricts the position of the check in the image.

Such restrictions are neither dependable nor user friendly and often still lead to rejection of the check. Imagine forcing the user to use the camera phone in a specific position to take the picture of the check. Often, such requirements result in users who stop using the service. Therefore, specialized technology is needed to overcome these challenges and to design a system that optimizes ease of use and offers high recognition standards to deal with the most common image processing problems in an unconstrained environment, such as the following:

- Arbitrary positioning of the check, including checks that are upside down or have a significant degree of perspective distortion
- Complex backgrounds, possibly including the presence of multiple objects of different colors and/or reflections
- Low contrast, including backgrounds that are lighter than the check, and insufficient lighting

For example, while the check shown below can be found and extracted correctly from the mobile photograph, improper processing will cause the check to become unusable.

Figure 1 – Examples of correctly and incorrectly finding the check in the image.

Mobile check and background objects	Correctly found and extracted: **Usable image**	Incorrectly found and extracted: **<u>Unusable</u> image. Banks <u>cannot</u> process it.**
		

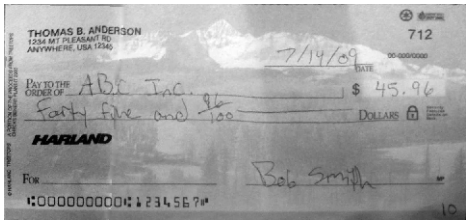
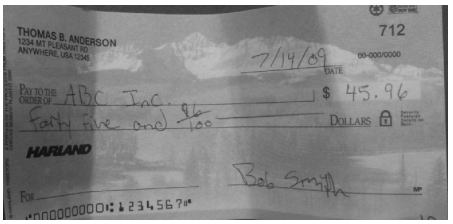
3.2 It's Hard to De-warp the Check Image

In real life, paper checks are often warped (folded) in various, irregular ways due to having been carried around in wallets, purses, or pockets. Traditional scanners deal with this situation by physically smoothing out the paper during scanning by pressing it between two flat surfaces. However, this is not the case with a mobile photo of a warped check.

Failure to de-warp results in an unreadable check and a failed deposit.

Without advanced de-warping techniques, a large number of all check images will be rejected by the bank's processing system (or flagged for manual processing), since the information on them cannot be extracted automatically. This leads to a large proportion of rejected or failed deposits and increased labor costs, frustrated users and damage to the bank's reputation and business.

Figure 2 – Examples of correctly and incorrectly de-warping the check image.

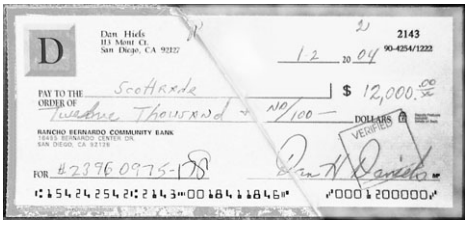
Warped check	Correctly detected and repaired: **Usable image**	Incorrectly detected and repaired (MICR cut off): **<u>Unusable</u> image. Banks <u>cannot</u> process it.**
		

3.3 It's Hard to Remove Shadows

Shadows frequently occur on mobile photos taken in bright sunlight, where an object obstructing the direct sunlight causes a deep shadow on part of the check. This problem does not usually appear in an indoor setting, and certainly never on an image scanned in a constrained environment. Undetected or unrepaired shadows result in unusable images, increasing the number of rejected images.

With advanced mobile imaging techniques, shadows can not only be detected, but often eliminated, preventing the need to ask the user to take the photo again.

Figure 3 – Examples of correctly and incorrectly removing shadows from the check image.

Check with shadows	Correctly detected and repaired: **Usable image**	Incorrectly processed: **<u>Unusable</u> image.** **Banks <u>cannot</u> process it.**
		

3.4 It's Hard to Read the MICR

The ability to accurately read the MICR line on mobile check images is one of the most important parts of mobile check deposit, because it contains key account and routing information. The system needs to be highly accurate and to detect problems early in the process. Reading the majority of checks correctly and rejecting just a few as illegible (rather than returning wrong data) is required for the system to be practical.

While the MICR data is required for depositing purposes, it is also an excellent indicator of overall mobile image quality. Therefore, a MICR confidence level should be used by the system to make real-time decisions to accept or reject a transaction. The decision depends on the chosen confidence threshold set by the bank, thereby implementing a "convenience vs. risk" tradeoff. A lower threshold yields fewer rejects (thus becoming more convenient for the user), but risks a higher error rate, and vice versa.

The ideal technology will deliver not only a highly accurate MICR-reading, but also an extremely reliable MICR-confidence metric which allows the application to reduce risks far below 1% while inconveniencing very few customers. The mobile MICR technology that you use should be just as accurate as check scanner technology, with a read rate (correct results) above 99% while keeping the error rate below the 1% threshold typically accepted by banks.

3.5 It's Hard to Read the Amount

It is difficult to read the amount on any check image, but even more so on mobile images because of unconstrained distortions. Yet because accuracy is paramount, the amount cannot be verified through lookup mechanisms the way that routing and account numbers can. The most reliable way to obtain the correct amount is to ask the user to enter it and to compare that value against the data extracted from the check image using CAR/LAR (Courtesy Amount Recognition / Legal Amount Recognition).
Barring intentional fraud, the user will enter the correct amount each time. Using the assumption that the user-entered amount is trusted, the system never needs to reject a deposit due to an uncertain amount. Instead, the amount can be automatically verified by using advanced "voting" logic that compares the courtesy, legal and user-entered amounts and associated data. This way, the system will merely flag deposits with mismatched amounts for review by the financial institution, rather than return them to the user. This improves the user experience significantly without affecting accuracy to any noticeable degree.

3.6 It's Hard to Do Alerts

Alerts are feedback messages from the system to the user. These messages can originate from the phone, from the mobile check deposit server, or from the financial institution's own system. For alerts to be useful, they have to be specific, which is often difficult. Alerts typically fall into the following three categories:

a) **Image quality issues**, which the user can correct by re-taking the photos
b) **Technical issues** which prevent the user from completing the deposit, e.g. wrong account password, no Internet connection, etc.
c) **Business issues**, such as exceeding a per-check or daily deposit limit, etc.

Obviously, the user can only correct the first type of issue, while the other two prevent them from making the deposit at that moment. However, it is still important to let the user know exactly why the transaction could not be completed and what they can do about it (e.g. take the photos again, wait for an Internet connection, or call the bank).

Of the three types of alerts, the first is the most difficult to offer actionable feedback. The system must offer as much specific assistance as possible to allow the user to take better pictures, given the large variety of potential image issues (insufficient lighting, cut-off corners, two front images, etc.). This requires an entire new class of photo analysis tools designed for the world of full-color, high-resolution, 3-D photographs: the mobile check imaging test suite. This new category of software is described later in this paper.

4 E-Mail and Browsers: Make-Believe Solutions

4.1 Email Is Not a Solution

Some vendors tout email as a solution to mobile check deposit. However, there are numerous serious issues with using email for this purpose. Systems based on email are neither secure nor easy to use.

Email's lack of security:

1) If the phone is lost or accessed by an unauthorized person, an email message left in the "Sent" folder is a security risk until the user deletes it. And doing that is easy to forget.

2) Encrypting email is too difficult to set up for most people, and therefore rarely done.

3) Copies of email messages and their attachments are stored on several servers along the route, where each server is a potential security risk. In addition, check images may reside on the phone unencrypted.

4) The email message must include the user's account identification (since the sender's email address alone likely does not identify the specific account to deposit into), the amount deposited, and likely additional information (e.g. a password or PIN).

5) It is easy to spoof an email address, pretending to be someone else.

Ease of use issues:

1) User must have email installed on the phone.

2) After taking the images, the user must open the email application on the phone, create a new message and attach the front and rear images of the check. This requires browsing through the images collected on the phone and selecting the correct images, in the correct order.

3) The user must enter identifying information for the transaction, which is tedious, error-prone **and** insecure (see above).

Integration issues:

Emailing information to a server somewhere does not constitute integration. Rather, it amounts to reckless publishing of sensitive data. Sending status updates to the user simply results in more unsecured data being released.

In addition, it becomes nearly impossible to provide the user with clear status updates regarding multiple deposits. Imagine searching through your inbox trying to find the latest status of two deposits you made last Tuesday. Or finding a message asking you to re-do a certain deposit, only to wonder if you did in fact do so. (Searching the "Sent" folder next??)

4.2 Browser-Based Systems Are Not a Solution

Another apparently easy solution, especially with regard to supporting multiple phone platforms, is a browser-based Web application. However, these applications suffer from many of the same security and usability issues as email-based systems. While browser connections can be secure (using HTTPS/SSL), the browser still often leaves sensitive information behind (copies of the check images, for example, or the login credentials in the cache).

But that's not all! Phone browsers suffer from additional limitations:

1) Some carriers deliberately disable the browser's ability to upload files, thus forcing their customers to upload images via the carrier's proprietary mechanism (e.g. a customized SMS app) for which they charge separate fees. Those mechanisms are not suitable for remote deposit capture.

2) There are countless versions of phone browsers, each with their own idiosyncrasies and limitations. New versions are often pushed to phones or released with new phones, and those new versions cannot be relied upon to be "better" for the purposes of mobile check deposit than their predecessors, since features and limitations are changed based on the carrier's business requirements.

Therefore, the idea that a browser-based application would provide a secure and supportable solution across multiple phone platforms is illusory. Such a solution can never be dependable, as there are too many variables out of the deposit vendor’s control, making maintaining the system and supporting users unmanageable.

5 The Gold Standard: Doing Mobile Check Deposit Right

Deploying mobile check deposit requires a whole new domain of extreme science. For example, mobile check deposit requires a brand-new class of mobile image analytics and repair, as well as recognition technology.

To achieve successful deployment, we've seen that the mobile check deposit system must convert a full-color, 3-D photo into a 2-D black-and-white image of a check, as well as satisfy another full range of acceptance conditions. The challenge is to do this while maintaining security, accuracy and ease of use. Therefore, as you consider deploying MRDC, you need to consider the following issues:

- End-to-end security
- Ease of use
- Accuracy
- Scalability and integration
- Support for many smartphone platforms
- Adherence to industry standards
- Mobile check imaging test suite

5.1 End-to-End Security

Any application running on the FI's servers or exchanging data with them must protect that data from unauthorized access or modification. The information provided by mobile check deposit must verifiably come from a known customer, be intended for an existing account, and use a valid check. Check images are not stored on the phone, and whatever information that does remain on the phone must be temporarily protected with passwords and state-of-the-art encryption.

The phone itself must implement industry standards for secure access, storage and transmission, such as those provided by the FFIEC (www.ffiec.gov) and other organizations.

The connection between the Mobile Deposit phone application and the Mobile Deposit server uses the industry-standard SSL (Secure Sockets Layer) protocol, which utilizes state-of-the-art 256-bit encryption. This is the same connection type used by all computers and browsers for all secure communications, such as online banking. This prevents so-called "man in the middle" attacks, where a third party intercepts the communication between the two parties (the phone and the server in this case) without their knowledge.

Duplicate check detection built into the mobile check deposit system is instrumental in helping curb both intentional and unintentional multiple presentment of a check. Fraud detection and prevention are greatly aided by two-factor authentication (i.e. uniquely identifiable phone plus username/password), by not storing sensitive data on the phone, and by keeping a complete audit trail of all transactions on the server. Risk management tools and fund availability policies must also be built in or integration "hooks" provided.

All these features can also be integrated into the FI's existing fraud prevention and protection systems, bringing mobile deposits under the FI's total security umbrella.

5.2 Ease of Use (Often Forgotten)

It is important to remember that one target audience for mobile check deposit is the casual user who typically deposits just a few checks per week—or a mobile professional. The plumber who visits your home and the vendor at a flea market would both like to accept checks risk-free. These users expect a streamlined workflow optimized to quickly deposit a single check. This differs from the requirements of a merchant with a stationary place of business depositing a batch of checks every day, who may opt for the speed of traditional check scanning, unbothered by the relative immobility of the device.

The mobile check deposit application must offer an easy to understand and streamlined user experience. Any application that does not immediately meet user needs in utility or ease of use will be discarded in favor of another one that does. Applications that deal with the user's finances are typically given slightly more leeway in terms of usability (or, rather, lack thereof). However, there are limits to that tolerance, and if an application exceeds those limits, the user will either switch to another application (if one is available) or revert to non-mobile methods such as going to a bank branch or an ATM. Therefore, a high rate of false rejections—where potentially valid check images are rejected—will annoy customers, jeopardize customer retention, and shrink service revenue.

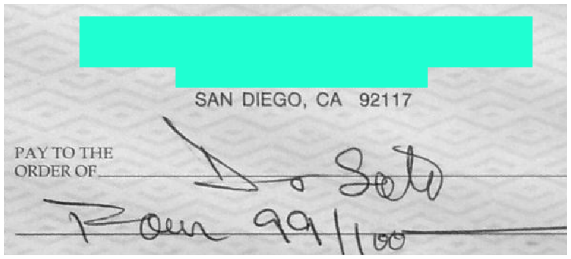
5.3 Accuracy

Nothing is as important to a user of a financial application as the protection of their money and related information. Protection includes not only data security, but accuracy, as well: wrong data may be as harmful as stolen data. Any discrepancies need to be displayed and resolved immediately, with options and remedies clearly spelled out. For example, it is preferable to reject an illegible check and ask the user to either resubmit the check or go to the bank rather than risk uploading wrong information. However, doing so must be the exception rather than the rule.

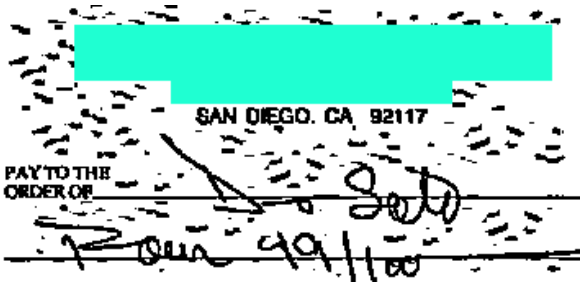
Fortunately, there is now mobile MICR technology available which has reached levels of accuracy approaching zero errors: the vast majority of MICR lines are read correctly, while the rest are rejected as illegible. Wrong answers are practically eliminated. And as mentioned earlier, the high accuracy achievable when reading the amount automatically, combined with the user's manual entering of the amount, eliminates most problems with this data set.

From its early days, check imaging technology has been faced with the issue of overcoming the security features designed into the check stock, which make modifying and copying (i.e. scanning) difficult. While this reduces the risk of fraud on paper checks, it makes the digital imaging world of checking much more difficult. Many of the "security backgrounds" printed on checks make it very difficult to automatically extract data from them. The following images show how important it is to use the proper advanced technology to remove traces of the background from scanned images. Failure to remove the security background results in poor images which the bank would either reject or process manually—both very undesirable choices.

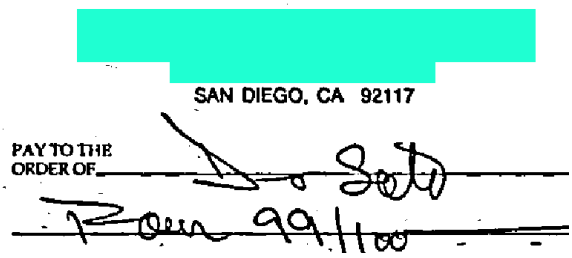
Original check with a diamond pattern secure background:



The same check after conversion to black-and-white using a primitive conversion: completely **un**suited for automatic processing:



The same check after conversion to black-and-white using advanced software: <u>well suited</u> for accurate automatic processing:

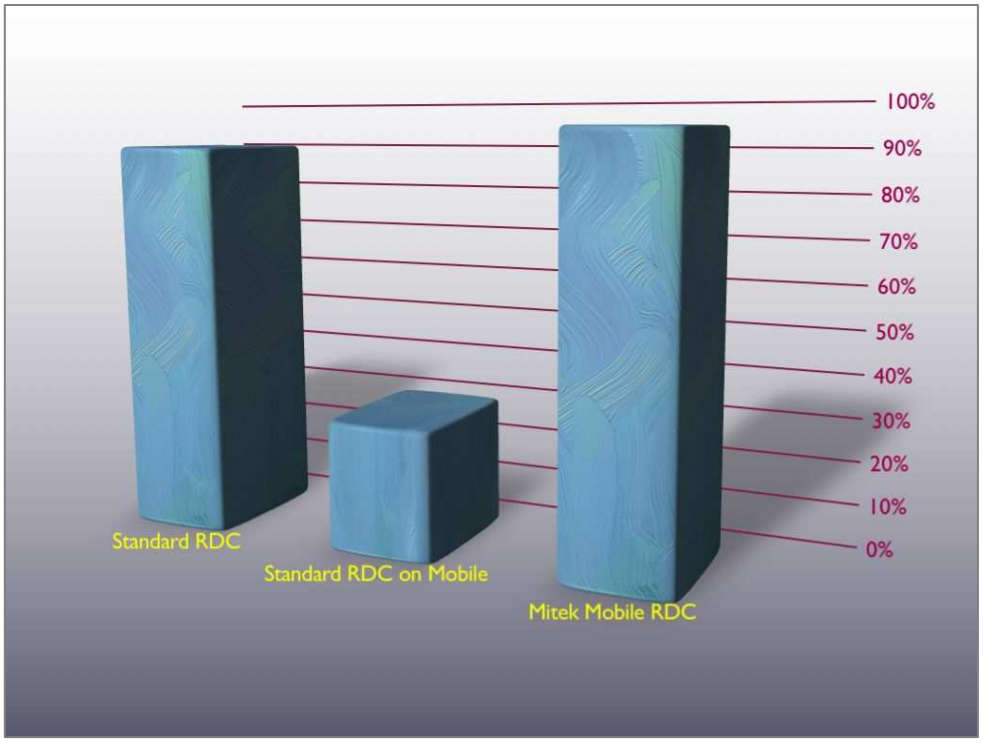


Caution: Using existing imaging system results in a bad user experience

The banking industry has made great strides in the processing of scanned check images. With current state of the art scanners and software, about 90% of all check images are read correctly and 10% are rejected as illegible. Those 10% require manual processing.

However, pictures taken with a camera are significantly different from a scanner image. We've discussed those differences and their impact already, so we'll just mention color, 3D-distortion and background interference. A system designed for scanner images is not equipped to deal with any of these issues. Therefore, the accept rate of such a system when presented with camera photographs plummets to between 30% and 50%! In other words, the number of transactions requiring manual review, and the associated per-check processing cost, increases five to sevenfold! While the financial institution bears the brunt of that cost, the users will still experience far more rejected deposits and (even worse) erroneous transactions.

This is why a system designed and built from the ground up to deal with true full-color photos is required. Mobile Deposit can successfully process 95% of all checks, reducing manual review overhead to a minimum. So you can choose between manually reviewing 70% of all checks, or just 5%.



5.4 Scalability & Integration

Both the mobile application and the servers it connects to must be able to scale to support large numbers of customers using the system concurrently during peak times, as well as interface with an FI's existing credentialing, deposit systems, business rules, and process flow. This is central to achieving the lowest possible Total Cost of Ownership (TCO).

Integration with mobile banking: The integration with existing mobile banking providers and systems can occur either as a stand-alone system that exchanges files or messages, or as a tightly integrated component within the existing mobile banking infrastructure. Regardless of the integration method, the mobile check deposit system must be able to handle massive amounts of concurrent uploads while maintaining low levels of latency.

Integration with check processing infrastructure (i.e. RDC, home deposit, item processing): When deploying mobile check deposit, it is of an advantage to leverage your existing system for workflow, risk management, fraud mitigation, etc. The mobile component should fit seamlessly into this existing infrastructure; in fact, the back-office system should not have to know or care how the transactions originated. Connecting to the features your existing infrastructure already offers reduces duplication, support efforts and TCO while increasing security and smoothing the integration path.

5.5 Support for Many Phone Platforms

There are countless phone models out there, based on a number of underlying platforms. Offering the service to a significant segment of the market requires supporting multiple platforms, each with its own development languages, features, restrictions, etc.

For example, RIM's BlackBerry phones fall into at least three major families, all of which differ noticeably from each other. Microsoft's Windows Mobile platform is undergoing a major revision from the current version 6 to the new version 7, which will not be backwardly compatible, requiring significant rewriting of existing Windows Mobile applications. Finally, different phone models sport very different cameras and optics, each requiring customized settings such as compression levels and image size to produce the best images for MRDC.

All of this results in a high TCO to maintain an offering across a wide segment of the smartphone market and needs to be considered when making a buy v. build decision.

5.6 Adherence to Industry Standards

Any check deposit system must adhere to multiple industry standards, such as Check 21, FFIEC's two-factor authentication (originally designed for ATMs, but applicable to mobile devices), and others. In addition, the introduction of full-color photographs adds the requirement for an entirely new set of standards: Mobile Check Imaging.

5.7 The Mobile Check Imaging Test Suite

We already discussed several of the major image analysis and repair challenges facing a mobile check deposit system. However, those are just the main ones from a long list of potential problems and conditions that must be tested for, then flagged **or repaired** if found. The list below shows the complete set of image analytics tests required by mobile check images. It is important to note that—given high-quality imaging software—many of the problems described here can often be repaired, allowing the deposit to be accepted and making for a good user experience.

There is no overlap between Check 21 image tests and mobile image tests, since the former are designed for black-and-white scanned (i.e. 2-D) images, while the latter are performed on full-color 3-D images. Even the Check 21 out-of-focus test, which alone is performed on a grayscale image, is designed for a scanned (2-D) image.

Image focus test
Test identifies blurry mobile images. Detection of blurry images is one of the most important Mobile IQA (Image Quality Analysis) tests as such images are often unusable in remote deposit capture systems. Undetected, black-and-white blurry images may be completely illegible, contain lots of black speckles ("noisy images") or both.

Partial shadow test
Test identifies mobile images partially covered by shadows. Some shadows render a mobile image unusable. The reason is that dark shadow creates very high contrast against white check background, causing the camera's software to "wash out" parts of the check.

Contrast test
Test identifies low-contrast mobile images. A photo taken under insufficient light will yield a low-contrast image. Because of this, poorly implemented black-and-white conversion software may incorrectly white out part of the foreground (such as MICR-line, amount or date) or black out part of the background, resulting in poor image quality.

Plain skew test
Test identifies photographs showing a significantly rotated check image. This skew can cause image quality problems, especially when the skew is large and results in cropping errors.

View skew test
Test identifies images with significant perspective distortion. Perspective distortion appears when the camera's direction is far from perpendicular to the document. The view skew does not usually cause image quality problems unless the angle is too large, when it becomes impossible to estimate the check's original size (personal v. business) or to read the MICR or amount data.

Cut corner test
Test identifies images with one or more corners of the document being cut off (located outside of the mobile image). Such cases may cause wrong MICR or amount recognition or loss of other important check data.

Cut side test
Test identifies images with one or more sides of the document being cut off (located outside of the mobile image). Such cases may cause wrong MICR or amount recognition or loss of other important check data.

Warped image test
Test identifies mobile images showing a significantly warped check. This occurs when the check was not flattened prior to taking the picture. Such cases may cause wrong MICR or amount recognition and substandard visual quality

Image size test
Test identifies mobile images showing a check taken from too great a distance. Although the software can correct for the size and for most perspective distortions, the resulting image will lack sufficient detail for processing. This is similar to zooming in too much on a photograph: the objects get bigger, but also blurrier.

MICR line test
Test identifies mobile images with an illegible or illegal MICR line.

Front-back mismatch test
Test identifies cases when front and back images were taken from different check types, i.e. personal and business checks.

Front as rear test
Test identifies cases when an image of the front of a check was submitted as an image of the back.

6 The Cost of Failure is Too High

As more and more users want to have their bank's services available on their smartphones, the banks must satisfy that demand or risk losing existing customers and not gaining new customers. On the other hand, implementing these services without addressing all corresponding challenges will lead to limited adoption, unacceptably high risk, data breaches, loss of customer trust and brand value. A bank deploying a mediocre service with serious issues will invariably be seen overall as a weak player, not worthy of the consumers' business and trust.

In short, banks have no choice but to deploy MRDC to stay competitive, but they must do so in a comprehensive, secure, user-friendly fashion that addresses all associated issues—or risk severe repercussions.

7 Mitek: The Leader in Gold Standard Innovation

Mitek created the *Gold Standard for Mobile Check Deposit* because the mobile RDC opportunity is irresistible, and requires new technology that is extremely difficult to do properly, while the cost of failure is simply unacceptable. Mitek has set the Gold Standard.

It's not just hard to build, it's expensive because it requires multi-disciplinary expertise to do it right. The cost for achieving this can be prodigious, because it requires expertise in smartphone platforms, network security, industrial strength server software and Web services, interface usability, advanced mobile imaging analysis and repair tools, and phone/server communication. And, after launching a Gold-Standard-capable application, it must be tested and certified and supported, and extended as telecom standards evolve.

Mitek Systems has been developing and marketing check processing systems for more than 20 years, establishing itself as the market leader in traditional back office check processing. Mitek staff have published papers, obtained numerous image processing and data extraction patents, and participated in major banking industry initiatives, such as FSTC's (www.fstc.org) creation of the industry-wide standard for image quality and usability metrics.

Now, Mitek has developed the next generation of check deposit software, designed specifically for the mobile marketplace. This extreme science has produced patent-pending innovations such as the extraordinary Mobile MICR whose accuracy reaches "four nines", i.e. 99.99%, Mobile IQA specific to phone cameras and check amount recognition with an accuracy of better than "87 @ 1" (87% of all checks read correctly with less than 1% error rate, and the remainder being illegible). Mitek is the leader in the new recognition domain of mobile imaging, turning the camera on any cell phone into a virtual scanner in your pocket.

Mitek Systems has partnered with the leading item processing and RDC vendors. As a result, its Mobile Deposit® supports all leading check processing systems, and allows for customized levels of integration with each, including their risk management tools. Mobile Deposit also satisfies all relevant industry standards, such as Check 21 image quality, FFIEC's two-factor authentication for security, and more.

Mitek set the *Gold Standard for Mobile Check Deposit*.

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V1.2 (8/3/2010)