'Appy Days' for Banknotes

One of the major and most far-reaching disruptive technologies of the last decade has been mobile technology – specifically smartphones, not-so-smartphones and tablets.

It is estimated that there are now around 7.2 billion such devices in the world, more than the number of people, and they are multiplying five times faster than the human population.

A key driver for smartphone and tablet usage is the mobile app (short for application), a self-contained program or piece of software designed to fulfil a particular purpose. No-one knows exactly how many apps there in the world, but Google estimates 5.5 million – a number which is also multiplying rapidly, as is their use. In 2008 there were 2.5 billion app downloads. By the end of this year, this figure is projected to be 224 billion.

One sector adding to this growth is the traditional one of currency, using the apps to help cash users, such as the public, retailers and the police, to identify and even authenticate circulating banknotes and coins.

These apps, usually iOS and Android based, provide details of Level 1 and some Level 2 security features, and how they can be identified such as by the commonly used 'look, feel and tilt' guidance.

It is now becoming increasingly common for new banknote issues to be accompanied by the launch of an app – and we have covered different apps in previous issues.

In this article, we provide an overview of the different types of apps – for familiarisation and identification, for authentication and also for recognition by the blind and visually-impaired – and look at some of the latest developments by central banks and banknote printers.

Static but interactive

Many currency apps provide users with static but interactive photographic imagery of banknotes which are currently circulating within a country. Such images indicate the position of security features within the note whilst also providing detailed images and explanatory text for each security feature. Often, an image is provided of the banknote viewed under ultraviolet (UV) or other light to see Level 2 security features invisible to the naked eye.

Apps using this format include ones from the Bank of England launched in March, and the State Bank of Pakistan last year.

The Bank of England's app includes existing notes as well as the new polymer £5 note. As well as showing detailed images, it also has a backlight function to show features in transmission (such as the watermark and embedded thread), includes a simulation on how the notes would look if viewed under UV light, and offers general advice, including what to do with suspected counterfeits.

Another example has been shown by Colombia, which introduced a new 100,000 peso banknote in March (see page 1). This was closely followed by the launch of their banknote app in April, which allows users to view the note's security features by rotating their smartphone as they would a banknote, holding it upwards as though to a light source and running their finger across the screen to 'feel' intaglio print (the smartphone vibrates).

The recently released 20,000 peso banknote has also been added to the app, and the remaining denominations of the new family will follow. The app also includes YouTube videos published by the Colombian central bank, and a link to the central bank's website.

Similar to the Colombian app is one developed by the Central Bank of Brazil in response to the influx of foreign visitors, first to the FIFA World Cup two years ago and now to the Olympic Games. The Brazilian app also include geo-positioning, which associates real-world locations (such as events and bureaux de change) to the user's location.
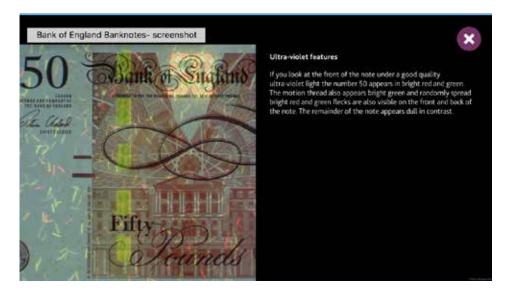
Commercial examples

In addition to central banks, banknote suppliers are also getting into the act to help support their customers.

De La Rue has recently released apps which include features that users can view by moving their smartphones in different ways in addition to static imagery, namely the Kingfisher banknote app and Barn Owl banknote app.

Giesecke & Devrient, meanwhile, has also been investigating opportunities for linking the analogue banknote world with mobile applications.

It presented one app concept at the Banknote Conference 2016, which automatically checks and verifies a picture of a banknote taken by the smartphone. Using South African rands as examples, the app shows static pictures of banknotes and provides an interactive experience regarding the behaviour of various security features.

For example, tilting the smartphone simulates the colour shift effect of the value numbers on the notes or the security thread as it can be viewed on real banknotes, the watermark on the banknote picture becomes visible when the phone is 'held to the light', and when lightly rubbing the picture of the banknote where the intaglio printing is, a tactile feedback can be experienced (through vibration) which is similar to the way a raised intaglio printing feels.

Bank of England Banknotes- screenshot

Ultra-violet features

If you look at the front of the note under a good quality ultra-violet light the number 50 appears in bright red and green. The motion thread also appears bright green and randomly spread bright red and green flecks are also visible on the front and back of the note. The remainder of the note appears dull in contrast.

Jura engineered intaglio-printed line feature for authentication by a smartphone.

TruNote provides physical banknote authentication.

The app shown was a teaser to demonstrate the functionality. G&D plans to develop it further, in particular to support multiple operating systems as the demonstrator currently only exists for iOS. In the meantime, it reports that number of customers have already indicated strong interest.

Apps for authentication

In addition to the features listed above, some banknote apps have been developed so that they are also able to scan a real banknote using the camera built into a smartphone or tablet device and then authenticate it.

The data captured by the camera is used by various algorithms to determine whether the banknote is likely to be genuine, usually by analysing the position of different design elements, or by reading various security features developed specifically for the purpose. If something on the scanned banknote does not match that which the app is expecting, a warning is shown on screen advising the user to perform an additional verification to confirm whether or not the note is authentic.

De Nederlandsche Bank (DNB), which was the first central bank to launch an app for checking and learning about the features of euro notes back in 2011 (the EuroBiljet), introduced a new version in early 2015. Called 'Genuine or Counterfeit', it focuses on discrepancies in print structures to determine the authenticity or otherwise of euro banknotes.

Russia's Goznak also launched a similar app in September 2015 that authenticates notes or flags them as suspect based on the printed structures.

The Swiss National Bank accompanied the release of the new CHF 50 franc this April with an app. When users position their smartphone over the new banknote, the app provides details of the note's security features and design elements. The SNB was assisted in the development of the app by Orell Fussli, which has been one of the pioneers in the development of security features that can be read, analysed and verified by apps.

And then there is Jura. It has developed a specially engineered intaglio-printed line feature for authentication by a smartphone app, which picks up the varying densities of the feature, as well as the different thicknesses, angles and structure of the dashed and continuous lines. First tested in a promotional 10 forint note celebrating the legendary footballer Puskas Ferenc, the feature and corresponding app have now been deployed in Hungary's 10,000 and 20,000 forint notes.

Apps for the visually impaired

The Bureau of Engraving & Printing (BEP) was the first organisation to develop an app – *Eyenote*™ – to enable the visually-impaired to distinguish between denominations. It works on Android and Apple phones and scans notes, using image recognition technology to determine their denomination.

It can identify and denominate all Federal Reserve notes issued since 1996. No special alignment of the note is required and, in a matter of seconds, it provides an audible or vibrating response. There have been 35,000 downloads since its launch in 2011.

More recently, an award winning banknote identification app called 'U-Qui-Ch-kun' (Universal Quick Checker for Bank of Japan notes) was developed by the National Printing Bureau (NPB) in Japan.

When a Japanese note is scanned using the smartphone or tablet device's camera, the app identifies the note and subsequently plays a message confirming its denomination for the user to hear. The denomination is also displayed on-screen in large text.

Voice control

Another app to help those with visual impairments is called *TruNote*™, developed by Spectra Systems, which was also launched at Banknote 2016. It is part of the new *TruBrand*™ technology provided by the company enabling the physical, non-image based authentication of products using a smartphone.

TruNote provides physical banknote authentication without the need for any special attachments. It utilises embedded covert signature materials in the print of a note that are analysed and 'read' on an iOS or Android smartphone using the app.

According to Spectra, other features of the covert material include its robust physical and chemical durability, ease of integration into existing production processes and its ease of authentication by way of a smartphone rather than a separate bespoke device or special smartphone attachment.

The app can be voice controlled for the visually impaired to check whether the note is authentic, and the banknote's denomination can be played audibly by the app for users to hear. The customisable app can even be configured to report GPS locations of suspect banknotes to the central bank.