

Binary Currency

An Antidote Against Corruption And Forgery

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Abstract The study is all about the combination of currency that is a physical currency note with a digital feature. Physical cash being dominant and easiest way for exchange it became easier for the counterfeiters to manufacture fake currency. Despite of technological advancements in exchange system which has become a trend, people do prefer using paper money. The printing technology to manufacture currency has become more advanced, that it made easy also for those trying to manufacture fake notes. Physical cash is unprotected and is a major reason to rising threats. Barcode money may protect against these imitations more effectively. This combination of currency is an effective way and counter measures against FICN. Further more the paper consist of a survey which shows that people feel more sure and reliable to use the digital mode over physical notes. Scaling from age group 18 to 45+ people see this binary currency notes as a secure way for transaction

Keywords —Physical Currency, Barcode technology, Digital security, Corruption, Fake Indian currency notes (FICN), Counterfeit.

I. INTRODUCTION

Fake currency is an imitation produced without the legal permission of the state or government usually is a very deliberate try to imitate that currency so on deceive its recipient. According to legal provisions against counterfeiting, printing and circulation of forged notes is an offence under section 489A to 489 E of Indian Penal Code (IPC) and is punishable by fine or imprisonment or both in the courts of law. India is 7th largest economy in the world measured by the nominal Gross Domestic Product (GDP) and 3rd largest by purchasing power parity. Printing fake notes ends up in reduction within the value of real money, corruption increases due holding of uncounted money also known has black money and there's increase in economic terror. These factors create obstacle within the overall economic process of the country. With technological advancement use of electronic money like debit cards/credit cards/online banking has made it easy to access. Though there are certain limitations because it is mostly employed in urban areas and rural areas ultimately suffer due to lack of technological reach. The idea of "Binary currency or Physical digital currency" is employed to trace and detect the fake notes quickly and simply, that so by the people with none hindrance.

The main objective of this paper is: 1. To makes currency notes safer. 2. To modify physical cash by adding digital features. 3. To abolish corruption and protect against

imitations of currency.

Some dimensions of frauds, corruption and forgery in earlier and modern time.

The report by CPI (corruption perception index) out of 180 countries India ranked 78th place in corruption list (2018 report). Pre demonetization, as per the report by security agency and indian statistical institution revealed that 400 cr fake currency notes of 500 and 1000 were circulated for 4 years 2011-2015. (Economic times).

According to the Financial Intelligent Unit (FIU) detected 480 percent jump in suspicious transaction, post demonetization and also the annual report by RBI's currency verification and processing system told the identical story. It states that, before demonetization 2.4 pieces of FICN of 500 RS and 5.8 pieces of 1000 RS every million pieces were found, which later increased to 5.5 pieces and 12.4 pieces respectively. (Business today report).

According to the study by Transparency International report 2015 recorded quite 62% of Indian was bribed in order to urge the work done. Which later declined by 20% within the year 2017 and came down to 50%.

II. LITERATURE REVIEW

The currency has great significance in everyday life. Therefore, many researchers have proposed various approaches. [1] Asokan et al. provide an overview article of

electronic payment systems. Based on seminal works on blind signatures, one line of research focuses on cryptographic digital cash systems similarly; several micro payment systems have also been proposed to pay for very small amounts.[2] Yoshida et al. have designed a machine vision-based framework for constant recognition of fake Bangladeshi monetary orders. The proposed framework based on five hundred and one hundred takas. The depended included is not conceivable to reproduce for the fake creators or makers. In the method, a restrictive scanner called Grid Scanner is used to captures the segments of the notes. The captured image is then prepared by a microcontroller PIC-16F648A or ATmega88 (AVR) and decides the legitimacy of note in the light of an OCR strategy.[3]Another line of research focuses on trusted hardware-based payment systems, for instance electronic wallets. On the other hand with these architectures, physical digital cash does not rely on external hardware to store balances and perform payments. [4] Leelasantham et al. have also proposed a strategy for investigating the water stamp on currency note by utilizing relationship mapping and background neural system. In this strategy, the area of water stamp is identified by interrelation mapping technique. Five types of notes like 20, 50, 100, 500 and 1000 of Thai cash note were prepared for 20 tests. The produced results have 100% of accuracy for recognizing the true currency notes.[5]Bruna et al. proposed a system that detects the counterfeit of euro banknotes .They used a near-infrared(NIR)light illuminator and a camera to capture the bank note image, this uses percentage of pixel that satisfy predetermined conditions inside pre defined region. Also it measures the correlation between the patches of the corresponding pixels to recognize the bank note type . It mainly calculates the performance based on speed and accuracy.[6]Jara et al. have discussed about the illegal activity of the false banknote and proposed a method that generally identifies the note using portable X-ray Fluorescence spectrometer (pXRF).According to the study of [7] Ismail and Makone have developed a software for identification of fake currency with the help of feature extraction classification based on an image by machine. The machine uses a camera to scan the image of a currency note and then the image is processed by the software with the help of character recognition methods and developed software by the use of MATLAB tool. Another method on image processing was done by [8]Agasti et.al. here processing was majorly based on feature extraction. After extracting the valuable features, the intensity has been computed. [9] Feng et al. proposed a new system based on two different methods namely skew correction and orientation identification to identify Renminbi Banknote (RMB) character from RMB images . After applying these two methods the binarization technique was used to compute the performance.

[10] Ahmad et al. developed a software system that detects the counterfeit currency based on its features like micro-printing, optically variable ink, watermark, iridescent ink, security thread and ultraviolet lines using OCR (Optical Character Recognition), Contour Analysis, Face Recognition, Speeded Up Robust Features (SURF) and Canny Edge and Hough transformation algorithm of Open CV.

Instead of looking at how one could replace physical note by digital payment system, this paper discuss about how to enhance the security level of physical note.

III. ABOUT BARCODE

A barcode is an encoded image that usually displays black and white lines of varying width that contains vital information and data which is easily readable by a machine. Barcodes store information using symbols that may vary from lines to dots, like within the matrix barcoding. Basically there are two main types of barcodes, one dimensional and two-dimensional barcodes. One dimensional barcode also known as linear barcodes can only store information horizontally from left to right. Linear barcodes can holds between 8-25 characters, but the more information stored the larger the barcode gets. 2D barcode can hold information both vertically and horizontally, it's capable of holding far more data – 4000 characters or more but 1D barcode only holds information horizontally, it's limited to merely some alphanumeric characters. 2D barcodes can hold information in both directions; it may be printed much smaller than its 1D for the identical amount of knowledge.

History of barcode:

The concept of barcode came in mid-30. Later, in 1948, Drexel Institute of Technology in Philadelphia was approached by a store owner asking about research for automatically reading product information during checkout. A graduate student at Drexel Institute named Bernard Silver along with his fellow student Norman Joseph Woodland, teamed together to develop a solution. Norman Joseph Woodland and Bernard Silver were granted a patent in 1952 for developing the modern barcode system. The idea was to create the checkout of articles easier, employing a code which was inspired by Morse code that was extended to thin and thick bars. Barcode system was commercially started by early 1970's and also the first U.P.C. scanner was installed at a Marsh's supermarket in Troy, Ohio on June 1974 and Wrigley's Gum was the primary product to possess a barcode. Bars & Stripes were then introduced to the market within the year 1991 by Tippecanoe Systems, Inc.

In the year 1994 QR codes was created by a Toyota subsidiary named Denso Wave . It developed the code in order to assist within the manufacturing process, they aided in tracking vehicles and parts. The design was to permit for

fast decoding speeds, for this very reason it absolutely was named as "Quick Response" or QR code.

The bank authority that introduced the primary machine readable numbers on bank notes in later 1989 was the Dutch financial institution, it introduced code numbering on bank notes and still it's the sole bank to register banknotes in circulation daily.

Type of barcode used

In this research two-dimensional barcode is utilized, it is called as QR code which stores encoded data and mostly the information could be a link to an internet site (URL). Quick response also called QR code could be a square shaped barcode that stores data both vertically and horizontally, which allows for its more versatile use. This type of barcodes are more complex that allows the users to accumulate anywhere between 1-4,000 characters of encoded data.

QR Codes can be generated up to 40 different symbol versions, starting from 21 x 21 modules (version 1) to 177 x 177 modules (version 40). Its version, type of characters and error-correction level decides the maximum amount of data the QR code can store. It can contain a proportionally larger amount of data, with each higher symbol version that has 4 additional modules per side (16 additional modules per symbol). The maximum storage capacity of QR code is: Numeric 7,089; Alpha numeric 4,296; Binary/byte2, 953; Kanji/kana1, 817. QR code or barcode are an optical label that contains all the information about the item to which it is attached.

Similar to the 1D barcodes, 2D barcodes have the identical uses like Inventory tracking, sale registry, supply chain management, mobile marketing, and logistics are just some other uses that of barcodes.

QR code or 2D barcodes encodes the image or link into a barcode that is uploaded or accessed via a picture scanner or smartphone's camera. QR system because of its fast readability and greater storage capacity became very popular not only in automotive industry but also in other industrial purposes for tracking and record management. QR Codes can't be hacked and recreated with the identical data without the permission of the core data holder.

BENEFITS OF QR CODE

Easy to use: QR code or barcodes serve a crucial role and provide great advantage in comparison with manually entering of information.

Quick and accurate: They are Quick and Error free as it is in a position to track items with a slip rate of about one error for each three million entries. At this rate, manual tracking would result in many human errors. As compared to humans, barcodes are nearly 10,000 times more accurate.

It is often effectively used for giant data storage and fast tracking is feasible as whenever scanned, there'll be an update within the database.

Impossible to Hack: There is no chance of two different QR codes with same action because every code encompasses a unique pattern and hence it's out of the question to control or hack the QR code.

Duplication free: Cover the QR Code with a "thin transparent film" which protects it and prevents the security features from fading, tampering or being duplicated.

Different ECC levels: A QR Code symbol can be decoded even if it gets dirty or damaged up to 30%. Each QR codes have four different levels of "error correction codes" or ECC. Higher the ECC level, the more readable the code becomes, even when damaged or is in bad condition.

Process of scanning

CCD and Imaging technologies based scanners are used for scanning 2D barcodes. This offers manual corded and cordless form like connected to IOS Android smartphones and tablets. Scanners have a check digit system that shows the barcode has been scanned correctly.

Once a barcode has been scanned the scanner will emit a beep sound and confirms by checking the check-digit. In this process the scanner uses a reflected light that consist of a laser technology which detect the black lines in a barcode or QR code.

QR Code when scanned using a smartphone or any of it scanner gets an immediate access to the content which will enable to easily identify the authenticity of the currency note.

Security Analysis

Since physical cash being anonymous, giving it a digital format, will add-on a safer value to the currency. This may be said as "Physical Digital Cash. Every barcode note contains a unique serial numbers, and any note quite one, having same identity will be easily detected by using bar code reader/ scanner. These serial numbers are going to be highly maintained by the government database. With each banking transaction of the barcode currency, notes are going to be scanned and details will be updated within the core-server, this permits the registration of the coded currency note on daily basis.

The best thing about this technology is that it is easily possible to trace the currency details, account number and also the place of last transaction of the currency note, so holding of cash won't be possible, which will ultimately end in lower corruption rate. Similarly, if the common user scans the note, the code is verified and if it matches the detail from the database it verifies it as an original note. This enables the note to be more forgery proof, because it

won't be possible for the counterfeiters to form similarly new serial number currencies with same QR code.

IV. SAMPLES USED

[A]



FIGURE: 1 QR CODE VERSION 1 IS USED FOR THE SAMPLE.

[B] Sample Currency Note



FIGURE: 2

This sample note shows 5 possible placements for QR code.

These placements of QR code is done, keeping in mind the 17 existing security feature of RS 500 sample note.

None of the genuine currency note security features is distorted.

[C] Result after scanning the sample note



Figure: 3 Sample Note with single QR code



Figure: 3.1

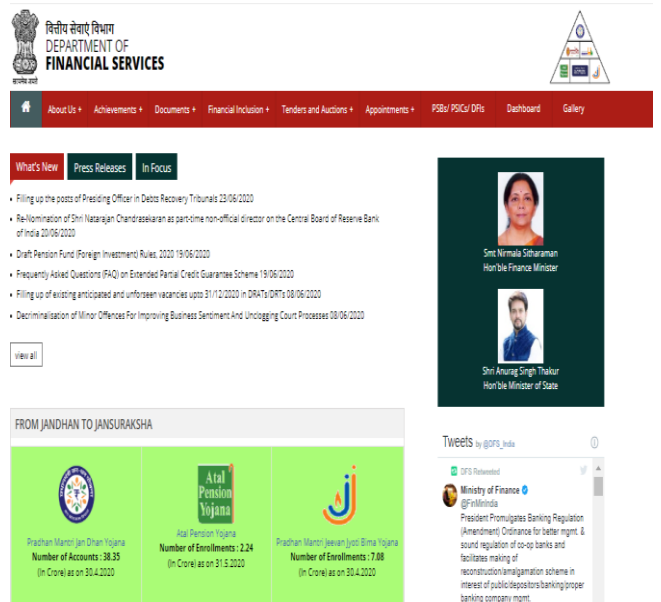


Figure: 4

After scanning the sample, it redirects to the home page of "MINISTRY OF FINANCE"

V. SURVEY ANALYSIS

The further data consist of survey that states public opinions about the research and what they think if physical digital currency is brought in daily use.

[A] HYPOTHESIS

H0: Adding the QR code or barcode on the currency note has no effect to the security measures.

H1: Adding the QR code or barcode on the currency note increases the security measures.

[B] RESEARCH DESIGN

Primary data : Survey based on Questionnaire.

Secondary data : Other research papers and websites.

Universe of the study: Mumbai and Navi Mumbai.

Samples : 500 people

(based on demographic segmentation that is age and profession.)

[C] FINDINGS OF THE STUDY

[1] HYPOTHESIS TESTING

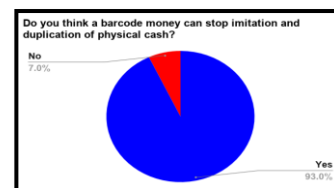


Figure 5: Based on Q8

Source: Primary data

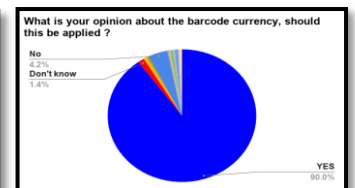


Figure 6: Based on Q10

Q8) Do you think barcode money can stop imitation and duplication of physical cash?

93 % people agreed to this question.

Figure 6:

Q10) *What is your opinion about the barcode currency, should it be applied?*

90 % people agreed to this question

The hypothesis testing is carried out based on these two questions , which clarifies that binary currency is more safe.

- According to the statistical data **H1 proves** to be applicable.
- It is safe and secure to use.

[2] CORRELATION TESTING

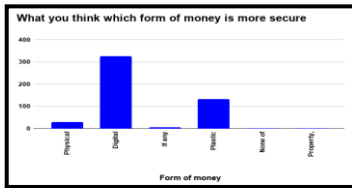


Figure 7: Based on Q4

Source: Primary data

Figure 7: Q4) *What you think which form of money is more secure?* Option includes Physical cash, Digital cash, Plastic money, Any other . Maximum people choose Digital cash (between 300-350).

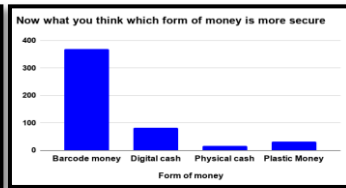


Figure 8: Based on Q9

Figure 8:Q9) *Now what you think which form of money is more secure?* Option includes Barcode money, Digital cash, Physical cash, Plastic money. Maximum people found barcode money secure (350+).

- The correlation explained is based on the relation between two questions Q4 and Q9.
- It shows positive relation between these variables,
- As it is observed, people see digital form of money more secure than other types (based on Q4).
- Hence, positive correlation is clearly justified with the increase in percentage that is observed in Q9.

[3] STATISTICAL DATA

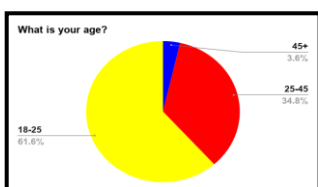


Figure 9: Based on Q1

Source: Primary data

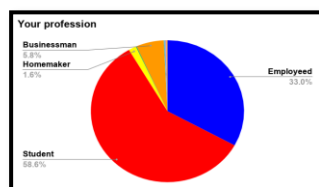


Figure 10: Based on Q2

Figure 9 and figure 10 questions are based on demographic distribution, this includes:

Q1) *Your Age (this includes age group from 18 to 45+)*

Q2) *Your Profession (this includes students, businessmen, employees, homemaker.)*

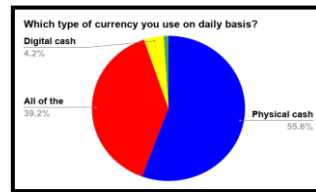


Figure 11: Based on Q3

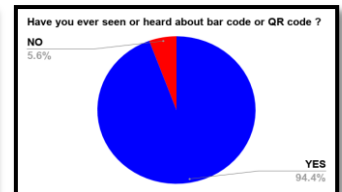


Figure 12: Based on Q5

Figure 11 and figure 12 talks about the usage of currency and knowledge about barcode.

Q3) *What type of money you use on daily basis?* Options includes Digital cash , Physical cash , Plastic money , All of the above.

The pie chart shows that 55.6% people prefer using physical cash on daily basis. This means though other forms of money and transactions are available, still more than 50% of population prefer using physical notes.

Q5) *Have you ever seen or heard about barcode or QRcode?* Options includes Yes or No.

Maximum people said yes , as barcode or QRcode is mostly seen everywhere, example:shopping, grocery, banks , e-wallets, etc.

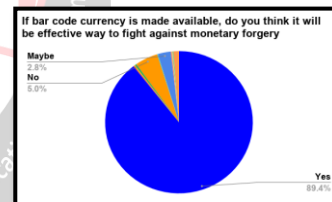


Figure 13: Based on Q6

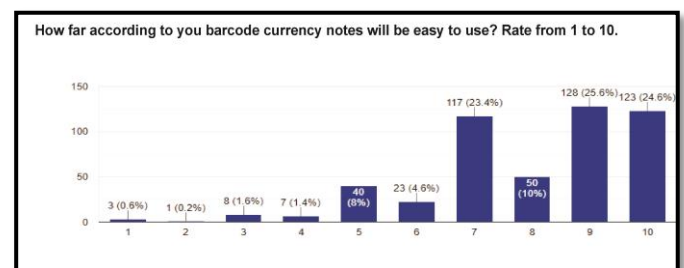


Figure 14: Based on Q7

Figure 13 and figure 14 states people opinion on binary currency.

Before Q6 and Q7 basic detail about the barcode or QR code was explained and a sample Rs500 Indian currency note (figure3) was provided to make people more aware about the concept.

Q6) *If barcode money is made available do you think it will be an effective way to fight against monetary forgery?*

89.4% people voted Yes.

Q7) How far according to you barcode currency notes will be easy to use. Rate from 1 to 10?

Maximum people voted 9 and 10 whereas; the positive statistic growth is seen as the rating is 7+.

[4] CONTRIBUTION & RECOMMENDATION

- According to above research maximum population is using physical cash.

For people:

- QR code notes will be a very convenient and safe as per the daily usage.
- It can be scanned and detected by anyone anywhere.

For government

- Scanning and detection features, enables to keep a track on the flow of currency.
- Reduction in corruption rate.
- Holding of money will not be possible.
- No more fake or imitated notes.

[5] LIMITATIONS OF STUDY

- Smartphones or other scanners are required for the process (scanning and detection).
- Network facility is must that is Internet connection.

[6] SCOPE FOR FURTHER RESEARCH

Technology used is QR Code (Barcode system); keeping in mind the process and security analysis, further research must study on different version of QR code and must look for the data used for detection of notes. There is limited scope for further research as data base and authenticity of the currency note completely rests in the hands of Ministry of Finance.

VI. CONCLUSION

The main aim of the paper is to make nation free from economic terror, corruption, counterfeiters, black money and strengthen it against the monetary forgery. According to the survey analysis it is clear that large number of population prefer using physical money and it is observed that there hasn't been any effective changes in the forgery rate post demonetization. Hence the above discussed technology is adequately subtle that it reduces the FICN to greater extent. Barcode being cost effective, with larger tracking speed, easy to detect and error free. It proves to be ideal for limiting the imitation of currency notes. Barcode scanner or reader can be installed easily in Banks, ATMs, Mobiles, Universities, Schools, Markets, Hospitals and

Public Administration, Offices ,etc. were cash transactions is available and also it becomes an effortless way for general people to scan them using their smartphones. The hypothesis testing and correlation testing gives a clear outcome that people will no longer have to suffer with the duplicate currency note threat as this digital feature on the physical note proves to be more secure and safe. With reference to this research, we believe that our initial approaches will encourage additional efforts in this important area.

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