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Unified Payment Interface - An Advancement in Payment System

SUBMITTED BY

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CERTIFICATE

This is to certify that

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Unified Payment Interface - An Advancement in Payment System

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***Abstract*— In this study the researcher aims to identify the customer preference towards unified payment interface and to know the impact of unified payment interface in customer satisfaction. Unified Payment Interface (UPI) is a payment system which facilitates the instant fund transfer between two bank accounts on the mobile platform. UPI is launched by National Payments Corporation of India (NPCI) and regulated by the Reserve Bank of India (RBI). UPI is built to extends Immediate Payment Service (IMPS) for transferring funds using account number with IFS Code, virtual payment address (a unique ID provided by the bank), Aadhaar Number, or a one-time use virtual ID, mobile number with MMID (Mobile Money Identifier). An MPIN (Mobile banking Personal Identification number) is compulsory to confirm each payment. UPI has made digital transaction for each and every individuals very ease like sending simple text messages. This service is available 24x7, not like RTGS or NEFT which don't work during non-banking hours or on holidays. This will bring extensive efficiency in the system and help India to become a truly cashless economy. It is secure, easy, cheap and more user friendly.**

***Keywords*—Aadhaar Integration, Cashless Transactions, E-commerce, Instant-transfer, Unified Payment Interface**

I. INTRODUCTION

The Indian economy has traditionally been heavily dominated by cash, over the fifteen years, India has made little slow but steady progress in E-Payments. Till now many methods are invented in E-Payments to digitize the current Banking system, including National Electronic Funds Transfer (NEFT), Real Time Gross Settlement (RTGS) and Immediate Payment Service (IMPS). So UPI is one of them. India is large scale country and so many are unbanked or don't know how to avail the banking services which are easy and secure. But due less literacy people facing difficulties in using banking services. So we needed to overcome these difficulties to make payment process easy.

An important contributor to the Indian digital payments market was the arrival of India's real-time payments platform, Unified Payments Interface (UPI). Government started NPCI (National Payments Corporation of India) in 2009, which controls all E Payments in India and it is setup with guidance and support of Reserve bank of India (RBI) and Indian bank association (IBA). This collaborative effort was focused on making India as a cashless economy.

II. EXISTING PAYMENT SYSTEM VS UPI

UPI, allows users to take the cashless path and transact digitally. It offers Instant Transfer of Money within few seconds, so it's practically real time money transfer, unlike NEFT or RTGS which works in batches and takes time in money transfer. It allow money transfer even on Holidays and outside working hours unlike NEFT or RTGS, where it doesn't allow money transfer on holidays or even Sundays.

The NCPI launched this payment system in between demonetization to encourage cashless transactions in the India and make mobile-based payments easier. Here the question is, what makes UPI better? This question especially arises when comparisons are made between UPI and IMPS, which offers similar features and benefits that are available through the UPI application.

The major differences between UPI and IMPS is the convenience that UPI gives to the customers, compared to IMPS. UPI allows complicated and lengthy information to be integrated into a simple virtual address. So, only that you need for a UPI transaction is a Virtual Payment Address (VPA). However, this is not the case with IMPS, where one needs the name of the account holder, the name of the bank, branch, IFSC code, and account number. Not just this, if a payment is being made for the first time to a payee, he/she needs to first be added as a beneficiary, but this is not the case with UPI.

III. TABLE 1

Comparison between UPI and other Existing services

	UPI	**Net banking**	**Card**
Payment information needed for authentication	UPI ID – simply like email id (4 digit MPIN)	Bank Login Bank Password OTP or PIN	16 digit card number CVV Card expiry Cardholder name OTP or ATM PIN

Mobile friendly design	High	Low	Low
Settlement to business account	1 Day	1-2 Days	1 Day
Success Rates	70-95%*	70%-90%	70%-95%

IV. WORKING MECHANISM OF UPI

UPI can be used to do transactions of money, who have internet enable smart phone and bank account. Below figure shows complete mechanism to use UPI.

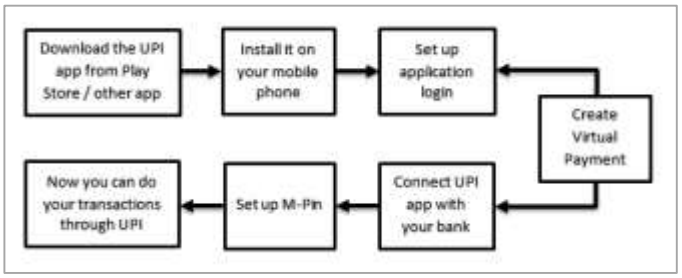

Fig. 1 Process mechanism to download and use UPI application

1) To get started with UPI, the users has to download UPI application from Google play store or from any other third party source. It is not mandatory that you should download app with respect to your bank account, you can download any other UPI application.
2) Now to use this application an authentication will be done for your respective bank account. For this authentication a request message will be send using your mobile number. Here we to remember that the SIM card of that mobile number should be already inserted inside your smart phone and that mobile number should be linked with bank account. Then by entering last 6 digits of debit card number, your bank account will get registered with UPI application.
3) Now in the next step VPA (virtual payment address) is to be created by user. VPA is the unique address like email id and every user will get unique id and it will get attached to their bank account and M-Pin is set for Bank account. For example if you are using Phone Pe application, then you will get VPA as userno1demo@ybl or 93215xxxx9@ybl.
4) User can now send and receive payment worth minimum ₹ 1 up to ₹ 100000 per day. Currently NPCI is not charging any money for the transactions of UPI.

V. CORE FEATURES

Unified Payment Interface provide the following core features via a single payment API and a set of supporting APIs.

1) Ability to use personal mobile as the primary device for all payments including person to person, person to entity, and entity to person.
2) Ability to use personal mobile to "pay" someone (push) as well as "collect" from someone (pull).
3) Ability to use Aadhaar number, mobile number, card number, and account number in a unified way. In addition, ability to pay and collect using "virtual payment addresses" that are "aliases" to accounts that may be payee/amount/time limited providing further security features.
4) Make payments only by providing an address with others without having ever provide account details or credentials on 3rd party applications or websites.
5) Ability for sending collect requests to others (person to person or entity to person) with "pay by" date to allow payment requests to be “snoozed” and paid later before expiry date without having to block the money in the account until customer is ready to pay.
6) Ability to pre-authorize multiple recurring payments similar to ECS (utilities, school fees, subscriptions, etc.) with a one-time secure authentication and rule based access.
7) Ability for all payment system players to use a standard set of APIs for any-to-any push and pull payments.
8) Ability to have PSP provided mobile applications that allow paying from any account using any number of virtual addresses using credentials such as passwords, PINs, or biometrics (on phone).
9) Ability to use a fully interoperable system across all payment system players without having silos and closed systems. Ability to make payments using 1-click 2-factor authentication all using just a personal phone without having any acquiring devices or having any physical tokens.

VI. ARCHITECTURE

Following diagram shows the overall architecture of the unified interface allowing USSD, smartphone, Internet banking, and other channel integration onto a common layer at NPCI. This common layer uses existing systems such as IMPS, AEPS, etc. to orchestrate these transactions and ensure settlement across accounts. Usage of existing systems ensure reliability of payment transactions across various channels and also takes full advantage of all the investments so far. This unified layer

offers next generation peer-to-peer immediate payment just by using personal phone.

As illustrated in the diagram, 3rd party API integration (merchant sites, etc.) can "collect" payment from “an address” avoiding the need to share account details or credentials on 3rd party applications or websites. Within this solution, payment authentication and authorization are always done using personal phone. Since this layer offers a unified interface, any-to-any (Aadhaar number, mobile, account, virtual addresses) payments to be done using standard set of APIs.

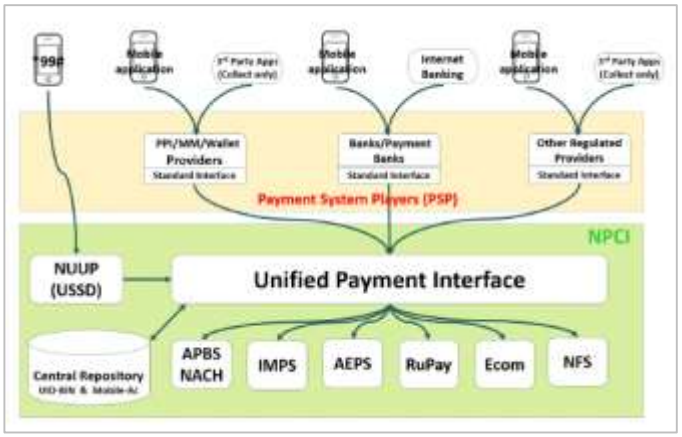

Fig. 2 Broad Architecture of UPI

VII. SUPPORTING INFRASTRUCTURE

1) *Aadhaar System:* One of the key considerations is to keep the Aadhaar system purely focused on identity and nothing else. The Aadhaar system only collects minimal data just enough to provide unique identity, issue the Aadhaar number after biometric de-duplication, manage lifecycle changes of that identity record, and provide a secure Application Programming Interface (API) for verifying the identity (online authentication) for various applications requiring identity verification. Designing the Aadhaar system as pure identity platform allows clear separation of duties and leaves usage of identity to other partners, and their various applications which may be built on top of the Aadhaar platform.

1.1) *Aadhaar Authentication*: Aadhaar authentication is the process wherein Aadhaar number, along with other attributes, including biometrics, are submitted online via an API to the UIDAI system for its verification on the basis of information or data or documents available with it. Authentication module handles online resident authentication from various Authentication User Agencies (AUA).

1.2) *Aadhaar e-KYC:* Verification of the Proof of Identity (PoI) and Proof of Address (PoA) is a key requirement for access to financial products (payment products, bank accounts, insurance products, market products, etc.).

The Aadhaar e-KYC service provides a convenient mechanism for agencies to offer an electronic, paperless KYC experience to Aadhaar holders. The e-KYC service provides simplicity to the resident, while providing cost-savings from processing paper documents and eliminating the risk of forged documents to the service agencies. This service is offered via an Application Programming Interface (API) that allows organizations to integrate Aadhaar e-KYC within their applications.

Aadhaar e-KYC service is now approved by the RBI as a valid KYC process.

1.3) *Aadhaar Enabled Account (AEA):* In order to facilitate disbursements, remittances or any financial transaction using Aadhaar as the financial address, a resident is required to link their Aadhaar number with his/her bank account number. Customers have the option of either linking their existing bank account or opening a new bank account.

1.4) *Aadhaar Payment Bridge (APB):* The Aadhaar Payments Bridge (APB) offers a simplified payment mechanism to Government user departments to electronically transfer subsidies and benefit payments to individuals on the basis of their Aadhaar number. APB system enables payments to be credited to end beneficiaries’ Aadhaar-enabled accounts (AEA) on the basis of Aadhaar number being unique identifier. The Aadhaar Payments Bridge will facilitate the processing of payments file from the Government departments received via the sponsor banks (assigned bank), and subsequently routing of the payments file to the beneficiaries bank. The beneficiary’s bank has the Aadhaar number mapping to the beneficiary’s bank account number to credit the amount in the end beneficiary’s account. Aadhaar Payments Bridge (APB) is a payments service offered by National Payments Corporation of India and the process for on-boarding of banks has also been defined by NPCI.

1.5) *Aadhaar Enabled Payment System (AEPS):* Aadhaar Enabled Payments System (AEPS) enables banks to route the financial transactions through a switching and clearing agency to empower the resident to use Aadhaar as his identity to authenticate and subsequently operate his respective Aadhaar enabled account and perform basic financial transactions.

2) *NPCI Central Mapper:* Aadhaar based payments are currently being processed using NACH application. For this purpose idea of mapping Aadhaar with Bank was first conceived and was institutionalized by NPCI.

Aadhaar is predominantly being used for transferring all types of government benefits. However recently Government also mandated that benefits can be transferred using Account Numbers as well.

Further considering the other financial revolution and reengineering which is currently going on in our country like Unified API, IMPS, USSD platform, NPCI Central Mapper can be used for fetching and routing their payments. Hence having such a common repository can create a great process value add, for overall payment ecosystem and as a consequence to the end customer.

2.1) *Aadhaar as the Payment Address:* NPCI has collaborated with Unique Identification Authority of India (UIDAI) to create a centralized Aadhaar mapper. The Aadhaar mapper, at present acts as an enabler for payment owing to the Aadhaar number mapping to the Account number as the financial address. NPCI has already build capabilities such as the e-KYC and Aadhaar Payment Bridge (APB) around this enablement.

2.2) *Mobile as the Payment Address:* NPCI is enhancing the central mapper to also have mobile to account mapping. This allows anyone to send/receive money from a mobile number without knowing the destination account details. Customers, via USSD, can manage multiple mobile to account mapping and conduct transactions via USSD. This feature also allows smartphone users to seamlessly interoperate with feature phone users. Unified Payment Interface allows PSPs to take full advantage of this mapping and allow their users to send/receive money just providing a destination mobile number.

VIII. OPPORTUNITIES AND POTENTIAL

1) Transaction limit of Rs 1,00,000 is a challenge for UPI. However, if this limit is increased by NPCI, UPI has enormous growth potential that will help big businessmen to make large payments thereby tapping a wider market.
2) To ensure proper security and convenience for the Customers, UPI can adopt Biometrics. As in Biometrics, the person is the key, so there's no need to remember the card details or UPI password. Each body part is unique and Biometrics uses a unique identity to enable a purchase or to transfer a specific amount. It encompasses Voice, Vein, Eye, Fingerprint, Facial recognition and more.
3) Recurring payment is a much anticipated feature of UPI which if launched will allow recurring payments like loan EMIs, mutual fund SIPs and other bill payments.
4) Cash transactions impose a huge financial burden on an economy. The costs are particularly high in developing economies such as India, where only a minuscule proportion of transactions are carried out through digital platforms. According to a study by Visa (2016), the cost of cash transactions in India was equivalent to 1.7 per cent of the gross domestic product (GDP). Creating infrastructure where citizen to government transactions and all government related transactions such as procurements are executed through digital platforms would logically be the first step for reducing such cost. UPI holds enormous growth potential as Indian population is the second largest user of smartphone with 28.5% Smartphone penetration (NewZoo, 2018). This increasing penetration of smartphone will work as a catalyst in reducing cost as well as adding to the potential UPI.

IX. SECURITY CONSIDERATIONS

For data security, the following classes of information are defined: Sensitive Data - Data such as PIN, passwords, biometrics, etc. These are not to be stored and should only be transported in encrypted form. Private Data - Data such as account number. This information may be stored by the PSP, but only in encrypted form. Non-Sensitive data - Name, transaction history (amount, timestamp, response code, location, etc.) that can be stored in unencrypted form.

1) *Protecting Account Details:* Protecting during capture. Verifying the account details with account provider (bank, PPI, etc. - new API may be needed from banks, or Re-1 transaction may be done to validate). PSPs storing the data should be always in encrypted form.
2) *Protecting Authentication Credentials:* Authentication credentials encrypted during capture using the public key of the authentication provider. Never in saved from capture till use**.** Never logged anywhere before it reaches provider. "Trusted" common library for credential (MPIN/Password/PIN/Biometrics) capture. This library needs to bind customer mobile using HOTP/TOTP which is verified as part of transaction.
3) *Protecting against Phishing:* 3 core techniques may be used to protect against phishing: Individual (nonentities) pay/collect transactions can be against pre-created and verified address (quite like in the case of NEFT). Allow direct/collect against ONLY whitelisted within the payer's pre-listed entries. Payer must add the payee explicitly into this list (quite life NEFT settings). During this, address verification can be done. For individuals PSP application should mandatorily share Aadhaar number and verified name which is part of customer information block which can be shown by the second PSP to their customer. For

entities PSP application should mandatorily share PAN number and verified name which is part of customer information block which can be shown by the second PSP to their customer. Whitelist entities (popular ones) and blacklist/rating at central database (NPCI) and show "verified symbol".

4) *Message Security, Trust, and Non-Reputability:* Every messages within the unified system must be digitally signed. Every message has unique transaction ID (that spans across the organizations for same transaction) and unique message ID for every request-response pair. All APIs must be done over a secure channel (HTTPS). Auditing transaction (no sensitive data) data for appropriate number of years.

X. BENEFITS

1) *Simplicity & ease of transacting:* Most people get bored if they have to fill in lengthy payee details, add a beneficiary and then make a fund transfer. Also, a bank cannot process a fund transfer using IMPS until and unless the beneficiary is added. Some banks, also have a waiting period up to 30 minutes, after which, user is allowed to make a fund transfer. This is not required in UPI as one does not need to provide any other details except the VPA to make a fund transfer.
2) *A single application with multiple bank accounts:* The UPI app gives users a convenient way to link all their existing bank accounts with one single application. Therefore, there is no need to download multiple applications for different bank accounts. All existing bank accounts can be linked in the application.
3) *Security:* The UPI application is also backed by the RBI and hence comes with many security features. UPI is safer than IMPS or other net banking service. Since here no bank account details or other account related data is provided, it is very safe and reliable. UPI works on a single click with two factor authentication system. It means that with a single click, the transaction will be verified at two levels. Every user will need a mobile phone along with a mobile pin known as M-PIN and virtual id. On a single click, the transaction is checked and if the mobile pin is matched with the virtual id, then only the transaction will going to be proceed.
4) *No charges are needed for transaction like IMPS:* Most banks do not charge a transaction fee for UPI transactions, unlike IMPS where a set fee is applied depending on the amount of money that is transferred.

XI. CONCLUSION

UPI is a great step towards making the cashless payments easier, smoother and faster. It is a complete set to become an efficient alternative to mobile wallets. It is a fantastic value based suggested scheme as it includes simple upgradable & acquiring infrastructure, simple authentication process and real- time money transfer, which makes the fund transfer experience user- friendly and hassle free. As we know that our most of the small transactions are still in done through cash. Hence the ease and convenience way of UPI offers the individuals to pay their day- to- day expenses like fund transfer, bill payments, etc. digitally.

UPI is a clear step towards breaking the hurdles that exist in the BFSI industry by removing the multi-step authentication processes with one-click process. UPI will definitely have an advantage over the existing digital wallets and streamlines the entire process.

On the other side, the ATM sector will further become stronger along with the existence of UPI as it will bring on more users into the digital age while hold on to their ATM accounts. Moreover, this will also help in the rise and adoption of card less ATMs, Aadhaar ATMs, with innovative new age technologies, where the ATMs will give cash without inserting ATM cards.

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