



Unified Payment Interface (UPI): A Cashless Indian e-Transaction Process

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ABSTRACT

Payment systems in India have undergone rapid changes during the past few years. The Vision Document on Payment Systems released by the Reserve Bank of India states several measures for building a 'less cash' society. The adoptions of mobile and card payment systems are two key components of this initiative. This paper presents an overview of a transformational project initiated recently by the National Payments Corporation of India (NPCI). This article aims to empower the bank customer to 'send' and 'collect' money in real time with just an e-mail, like a financial address, both for person-to-person (P2P) payments and Business to Consumer (B2C) Collect. This paper also includes the comparison study of different UPI Apps.

Keywords: NPCI, UPI, PSP, 2-FA, AEPS, APB

NPCI received the Certificate of Commencement of Business in April 2009. NPCI has 10 promoter banks namely, State Bank of India, Punjab National Bank, Canara Bank, Bank of Baroda, Union Bank of India, Bank of India, ICICI Bank, HDFC Bank, Citibank and HSBC. NPCI aims to create infrastructure which rests on the principle of large scale and high volumes resulting in payment services at a fraction of the present cost structure. NPCI operates on an asset-light business strategy in the payment industry in India. The industry is at an inflexion point led by fast-changing consumer behavior, government/regulatory initiatives, ever-increasing entrepreneurial activity and strong investor appetite. NPCI is playing a pivotal role in evolving digital payment industry in India through multiple products, including the flagship products – RuPay and UPI.^{[1][3][6]}

RuPay is NPCI's card payment network which is accepted at ATMs, PoS machines and e-commerce sites. RuPay offers lower charges than its global competitors like Visa and MasterCard. Key benefits of RuPay includes lower cost and affordability, and penetration in the untapped/unexplored consumer

segment. RuPay card is uniquely positioned to offer complete inter-operability between various payments channels and products.



Fig. 1: Mobile Payment Ecosystem in India^[4]

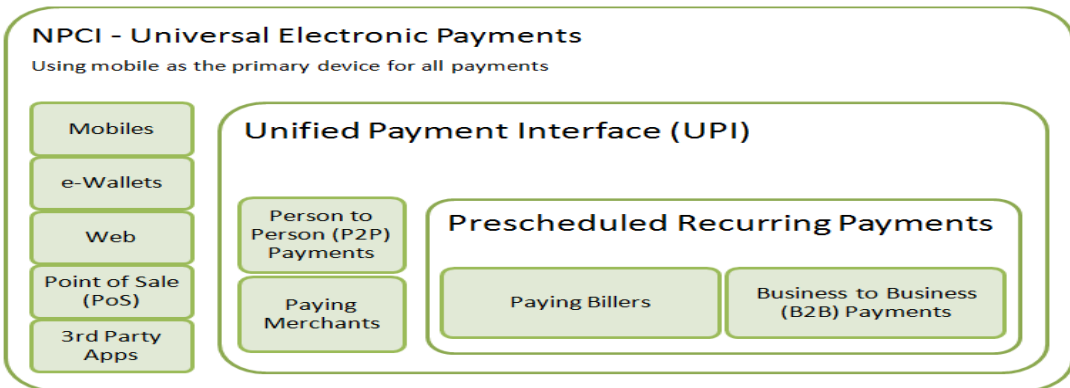


Fig. 2: Conceptual Model of Universal Electronic Payments

UNIFIED PAYMENTS INTERFACE: UPI

UPI is a simple payment tool created by NPCI that is based on IMPS system. UPI can operate on a smart phone and it works as an email ID for money. It facilitates virtual Payment address (VPA: A VPA is an ID, which a user creates by linking their accounts to a bank’s mobile application) as a payment identifier for sending and collecting money and works on single click 2 factor authentications (2-FA). It also provides an option for scheduling push and pull transactions for various purposes like sharing bills among peers. One can use UPI app instead of paying cash on delivery on receipt of product from online shopping websites and can perform miscellaneous expenses like paying utility bills, over the counter payments,

barcode (scan and pay) based payments, donations, school fees and other such unique and innovative use cases. UPI will offer a facility to identify a bank customer with an email-like virtual address. It allows a customer to have multiple virtual addresses for multiple accounts in various banks. To ensure privacy of customer's data, there is no account number mapper anywhere other than the customer's own bank. This allows the customer to freely share the financial address with others. A customer can also decide to use the mobile number as the name instead of the short name for the virtual address.^{[1][2][7]}

Features of UPI

- ❖ Immediate money transfer through mobile device round the clock 24*7 and 365 days.
- ❖ Single mobile application for accessing different bank accounts
- ❖ Single Click 2 Factor Authentication – Aligned with the Regulatory guidelines, yet provides for a very strong feature of seamless single click payment.
- ❖ **Virtual address** of the customer for Pull & Push provides for incremental security with the customer not required to enter the details such as Card no, Account number; IFSC etc.
- ❖ Bill Sharing with friends, Best answer to Cash on Delivery hassle, running to an ATM or rendering exact amount, Merchant Payment with Single Application or In-App Payments, Utility Bill Payments, Over the Counter Payments, Barcode (Scan and Pay) based payments, Donations, Collections, Disbursements Scalable.
- ❖ Raising Complaint from Mobile App directly.

UPI PRODUCT

There are two types of UPI Products:^{[5][9]}

1. **Financial Transactions:** UPI supports the following financial transactions.
 - ⊙ *Pay Request:* A Pay Request is a transaction where the initiating customer is pushing funds to the intended beneficiary. Payment Addresses include Mobile Number & Mobile Money Identifier (MMID), Account Number & IFSC and Virtual ID.
 - ⊙ *Collect Request:* A Collect Request is a transaction where the customer is pulling funds from the intended remitter by using Virtual ID.
2. **Non-Financial Transactions:** UPI will support following types of non-financial transactions:
 - ⊙ Mobile Banking Registration
 - ⊙ Generate One Time Password (OTP)
 - ⊙ Set/Change PIN
 - ⊙ Check Transaction Status
 - ⊙ Raise Dispute/Raise query

Technical Architecture of UPI Gateway

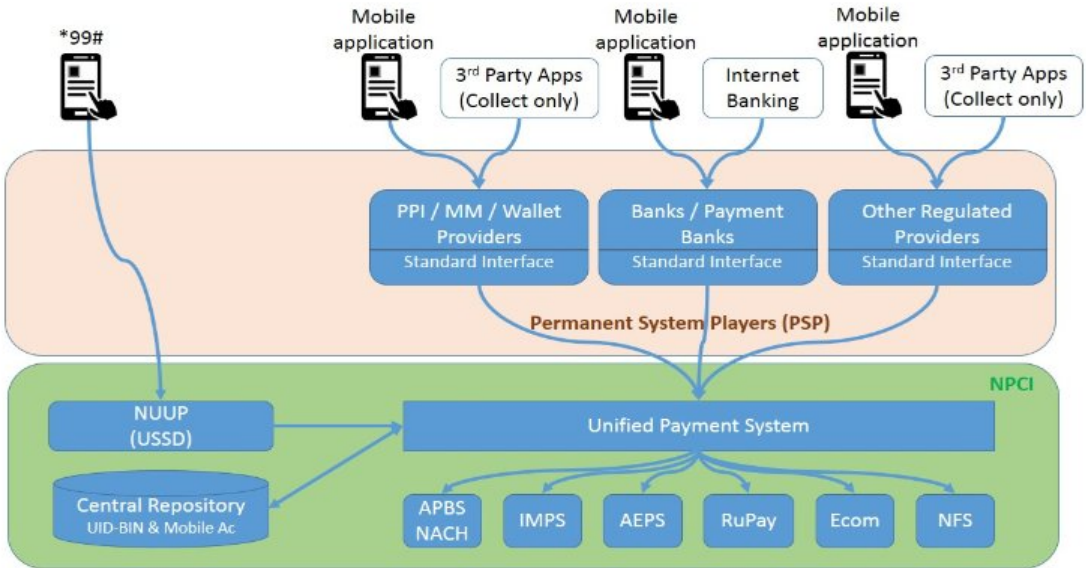


Fig. 3: Architecture of UPI Gateway^{[4][5][8]}

UPI TRANSACTION FLOW WITH E-COMMERCE SITE

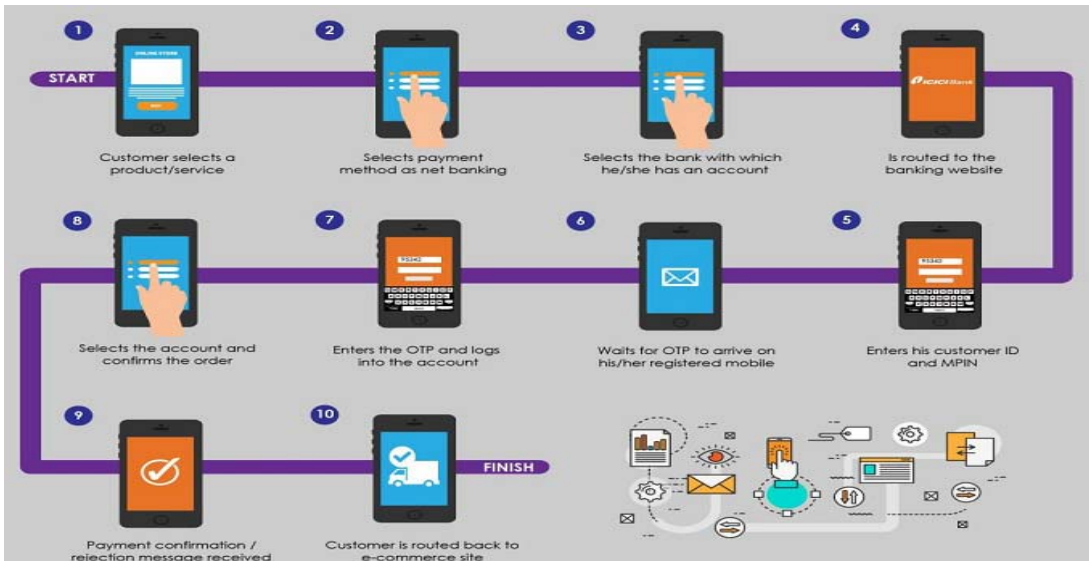


Fig. 4: Steps for UPI Transaction Flow

The Process Comprises of following steps:

- ❖ Customer selects a Product or Service.
- ❖ Customer selects payment method as net banking.
- ❖ He or she selects the bank with which he or she has an account.
- ❖ The customer is routed towards the bank website.
- ❖ Customer enters his or her Customer ID and Mobile Pin (MPIN).
- ❖ Then he or she waits for the OTP to arrive on his or her registered mobile.
- ❖ Then Customer enters the OTP and logs into the account.
- ❖ Then he or she selects the account and confirm the order.
- ❖ The payment confirmation or rejection message will be received.
- ❖ Finally Customer is routed back to e-Commerce site.

PAYMENTS STRUCTURE OF UPI

Direct Pay

- ❖ *Sender Initiated*: Sender provides his credentials and receiver`s virtual address using his payment application.
- ❖ *System initiated*: Digitally signed request with receiver virtual address.

Sending Money on UPI

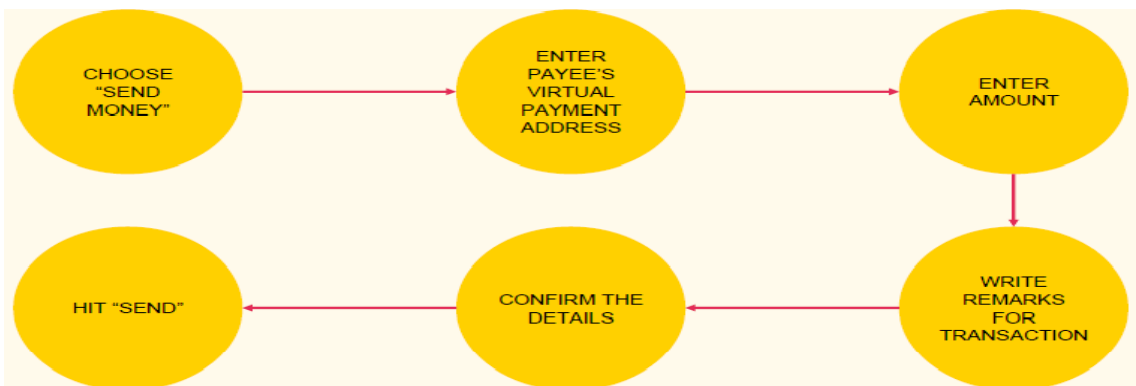


Fig. 5: Flowchart of Sending Money using UPI^{[2][6]}

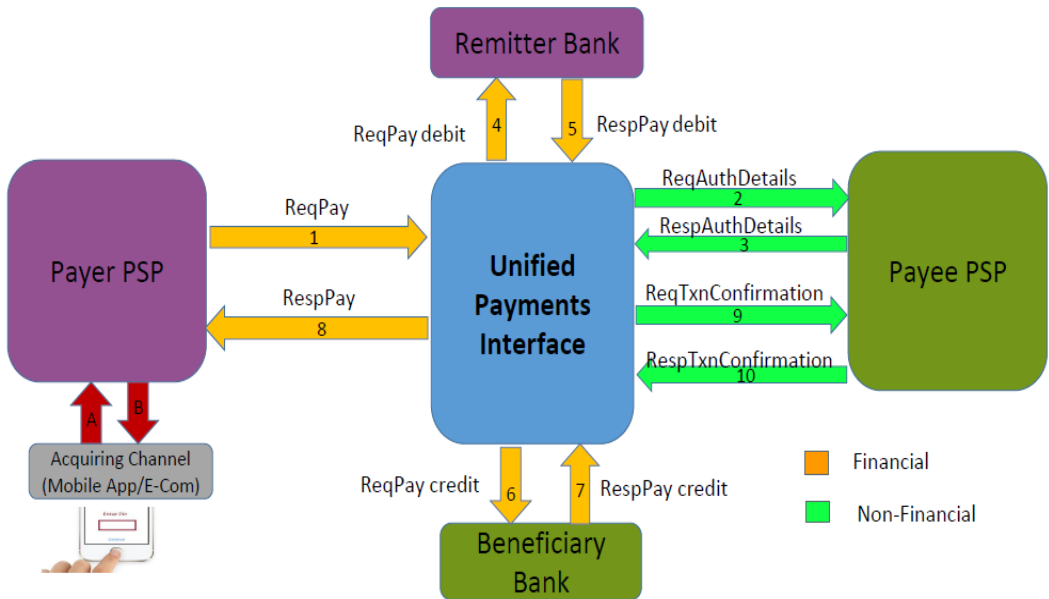


Fig. 6: Pay Money on UPI through Mobile

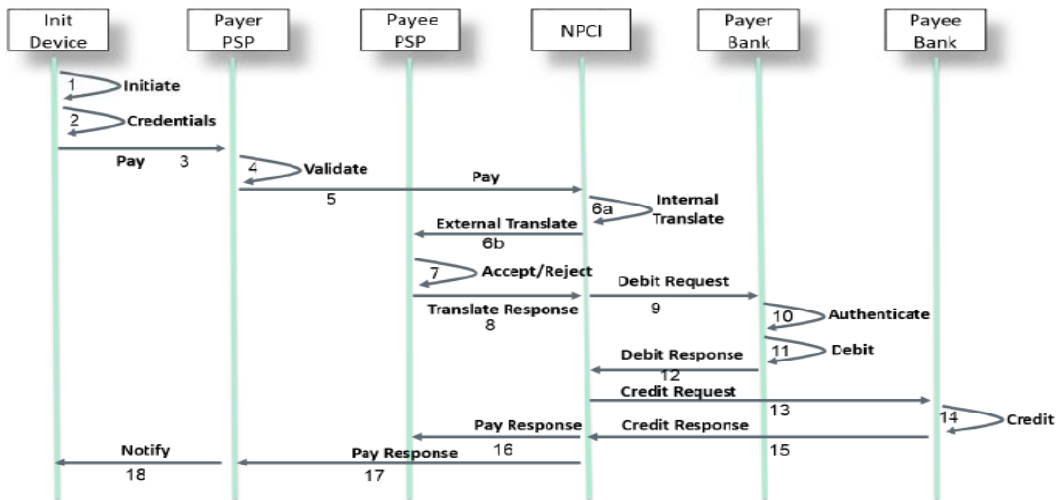


Fig. 7: Direct Pay Transaction Flow

Collect Pay

- ❖ **Remote Collect:** Payee send the request to the payer (through USSD or Smartphone) on his phone. So the payee doesn't have to enter any credential. Local exchange of encrypted credential is not

currently supported in UPI. The sender's phone on the arrival of request become point of entry of secure credentials.

❖ *Local Collect*: Here the payer's address is captured to send the payment request

Collecting Money on UPI

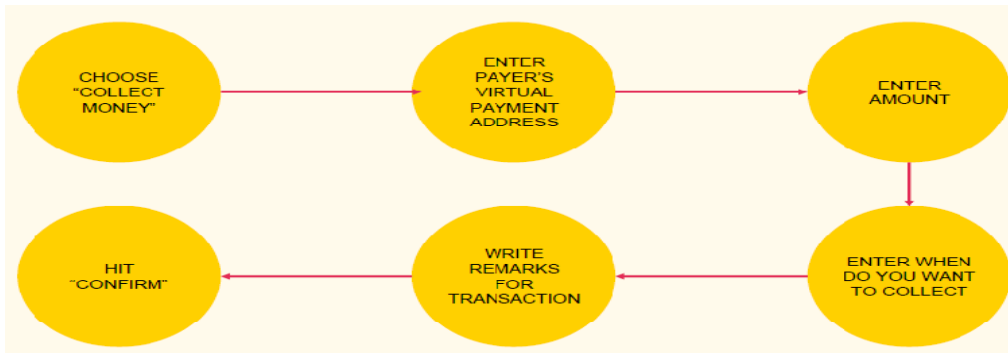


Fig. 8: Flowchart of Collecting Money on UPI^{[2][8]}

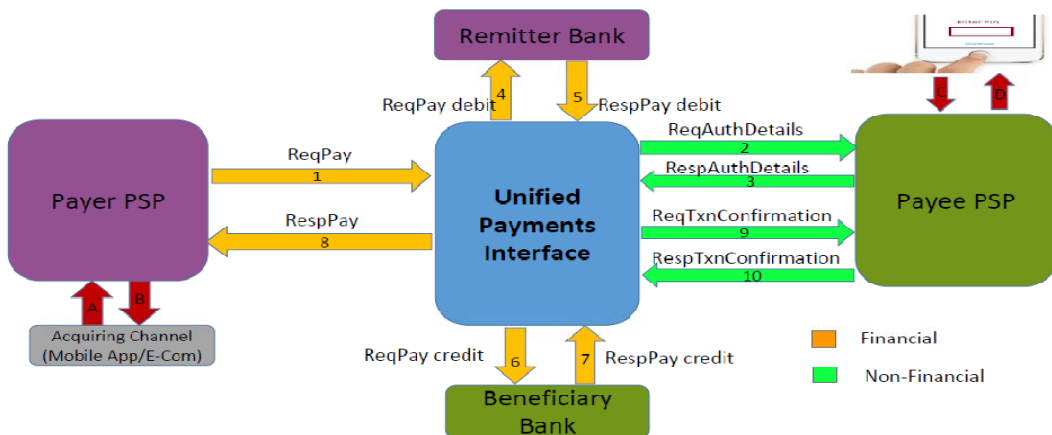


Fig. 9: Collect Money on UPI through Mobile

COMPARATIVE STUDY ON PAYTM, UPI, SBI BUDDY AND BHIM (GOVERNMENT UNDERTAKING)^{[5][9][10]}

Paytm

Paytm has been the go to app since demonetization stroke at midnight of November 9. This payment wallet added five million new users and made record transactions worth of ₹ 120 crore every day. The

user interface is currently available in English and ten different regional languages including Hindi, Tamil, Telugu, Gujarati, Marathi, Bengali, Kannada, Malayalam, Oriya and Punjabi. Paytm also offers the options of booking movie tickets, recharge mobiles and DTH, pay bills, etc. with different cash back benefits. Paytm is approved as an operating unit for Bharat Bill Payment System, making it a secure way to pay for various bills. Paytm charges 4 per cent for customers who have not completed their KYC and 1 per cent for KYC compliant customers. Paytm allows us to transfer money to a mobile number or banks as well. However, this transaction is capped at ₹ 25000 per month.

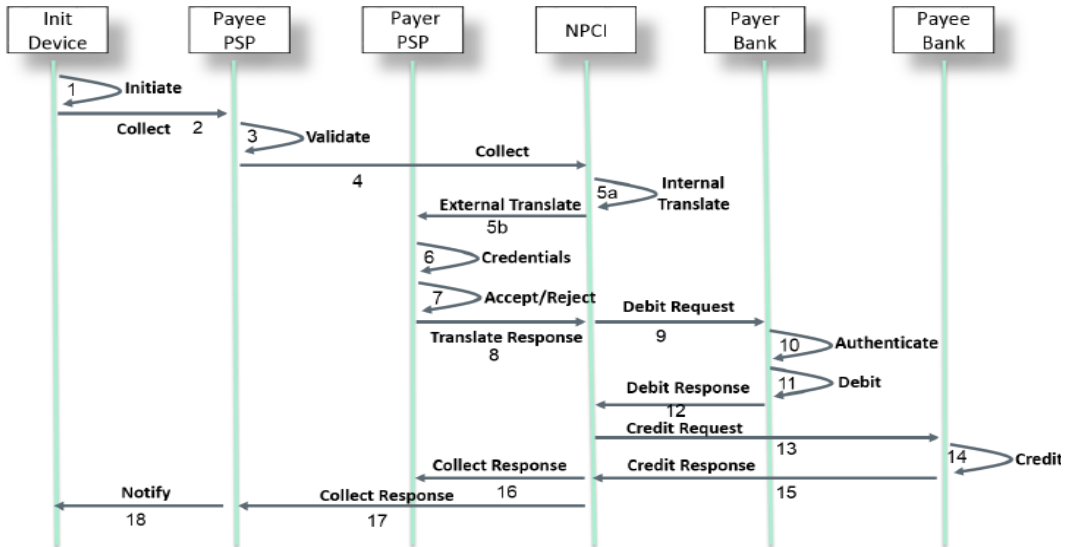


Fig. 10: Collect Pay Transaction Flow

SBI Buddy

State Bank of India(SBI) launched its payment app, SBI Buddy, early last year. SBI Buddy is a semi-closed prepaid wallet which is used to transfer money to other payment wallets, bank accounts anywhere at any time. The app also allows you to make payments at shopping malls and recharge and pay bills. The biggest highlight for the Buddy App is that it is backed by the banking giant, government-owned, State Bank of India. This app is also available in 13 languages: Assamese, Bengali, English, Gujarati, Hindi, Kannada, Malayalam, Marathi, Oriya, Punjabi, Tamil, Telugu, and Urdu. The SBI Buddy App has a monthly transaction limit of ₹ 20000 for Non-KYC customers and ₹ 100000 for KYC customers on merchant transactions and fund transfers. The app also has a cap of ₹ 20000 for non-KYC customers and ₹ 25000 for KYC customers for transfer to bank account.

BHIM

BHIM, the app is currently only available in Hindi and English. BHIM is not a payment wallet which requires a prepaid payment, it essentially connects your bank accounts to make easier payments. BHIM can be accessed through various platforms, like UPI, IFSC and MMID and unique QR code. The app is

connected to our Adhaar, making it more secure and as it is under the government's umbrella is can be trusted more than the other options. The App also has a three-step security method for making payments, assuring us of its security. A negative point for BHIM will be the low transaction cut. BHIM App currently has a transaction limit of ₹ 20,000 per day and the maximum amount per transaction is kept at ₹ 10,000.

UPI

UPI is a system that powers multiple bank accounts into a single mobile application (of any participating bank), merging several banking features, seamless fund routing & merchant payments into one hood. Any UPI app can be downloaded by Smartphone users who can choose their bank as the preferred UPI payment track. The transaction limits on UPI Apps depends on different banks for which it is made.

Table 1: UPI Analytics

Month	No. of Banks live on UPI	Volume	Amount (₹ in Mn)
Aug-16	21	92,856	30.92
Sep-16	25	85,115	326.37
Oct-16	26	1,03,060	485.73
Nov-16	30	2,85,402	1,004.58
Dec-16	35	19,67,140	7,061.66
Jan-17	36	41,52,724	16,588.02
Feb-17	44	41,55,944	19,020.67
Mar-17	44	61,61,259	23,913.78

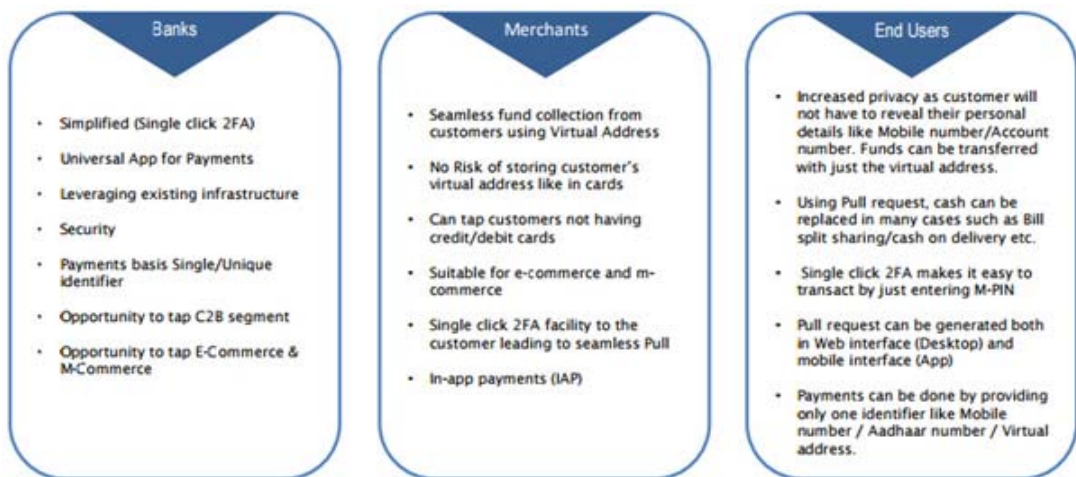


Fig. 11: Benefits of using UPI ^[10]

COMPARISON BETWEEN DIFFERENT PSP UPI APPS

Table 2: Comparison between different PSP APPs^{[3][11][12]}

Sl. No.	PSP APP Name	PSP Bank	Technology Vendor	Pay	Collect	Split Payment	Indic Support	Dual Sim Support	QR Code	UPI Link	In-App Scanner	Adhaar Payment	Bill Payment	Help Text
1	UPI	Allahabad Bank	LCode	Y	Y	N	N	NA	Y	Y	Y	Y	Y	N
2	ONE - UPI App	Andhra Bank	Olive	Y	Y	N	N	Y	Y	Y	Y	Y	Y	N
3	AxisPay	Axis Bank		Y	Y	N	N	N	Y	Y	N	N	Y	Y
4	Baroda MPay	Bank of Baroda		Y	Y	N	N	Y	Y	Y	Y	N	Y	Y
5	BHIM	NPCI	JusPay	Y	Y	N	English, Hindi, Bengali, Gujarati, Kannada, Malayalam, Oriya, Tamil, Telugu	Y	Y	Y	Y	Y	N	N
6	BHIM iOS	NPCI	JusPay	Y	Y	N	English, Hindi, Bengali, Gujarati, Kannada, Malayalam, Oriya, Tamil, Telugu	Y	Y	Y	N	N	N	N
7	UPI - empower	Canara Bank	NPST	Y	Y	N	Hindi + English	Y	Y	Y	N	Y	Y	N
8	Cent UPI	Central Bank of India	Infrasoft Tech	Y	Y	N	N	Y	N	N	N	N	N	N
9	Chillr	HDFC Bank	Chillr	Y	Y		N	Y	Y	Y	Y	N	N	N
10	CSB-UPI	Catholic Syrian Bank	LCode	Y	Y	N	N	Y	N	Y	N	N	N	Y
11	DCB Bank UPI App	DCB Bank	Olive	Y	Y	N	N	Y	N	N	N	N	N	N
12	Dena Bank E-UPI	Dena Bank		Y	Y	N	N	Y	Y	Y	N	Y	N	Y
13	Mobile Banking	HDFC Bank		Y	Y	N	N	Y	N	Y	Y	Y	N	Y
14	HSBC Simply Pay	HSBC Bank	MGS	Y	Y	N	N	N	Y	Y	Y	N	N	Y
14	UPI App	IDFC Bank	FSS	Y	Y	N	N	Y	Y	Y	Y	Y	N	Y
15	iMobile	ICICI Bank		Y	Y	N	N	Y	Y	Y	Y	N	N	N
16	Indian Bank UPI	Indian Bank	Infrasoft Tech	Y	Y	Y	N	Y	Y	Y	N	Y	N	Y

17	IndusPay UPI App	IndusInd Bank	MGS	Y	Y	N	N	Y	Y	Y	Y	N	N	N
18	KayPay	Kotak Mahindra Bank	Olive	Y	Y	Y	N	Y	Y	Y	N	Y	N	Y
19	KBL SMARTz	Karnataka Bank	LCode	Y	Y	N	N	N	Y	Y	Y	N	N	Y
20	Lotza-UPI	Federal Bank		Y	Y	N	N	Y	Y	Y	Y	N	Y	Y
21	Maha UPI	Bank of Maharashtra	Infrasoft Tech	Y	Y	N	N	NA	Y	Y	Y	N	Y	Y
22	NuPay	Yes Bank	NuPay	Y	Y	N	Y	Y	Y	Y	Y	Y	N	N
23	OBCUPI PSP	OBC Bank	MGS	Y	Y	N	N	Y	N	N	N	N	N	Y
24	PaySay	Yes Bank	Cheripo	Y	Y	Y	N	N	Y	Y	Y	N	N	Y
25	PhonePe	Yes Bank	FXMart (Flipkart)	Y	Y	Y	English, Hindi, Tamil, Marathi & Bengali	Y	Y	Y	N	N	N	Y
26	PhonePe iOS	Yes Bank	FXMart (Flipkart)	Y	Y	Y	English, Hindi, Tamil	Y	Y	Y	N	Y	N	N
27	PNB UPI	Punjab National Bank	FSS	Y	Y	N	N	N	Y	Y	Y	N	N	Y
28	Pockets	ICICI Pockets		Y	Y	N	N	Y	Y	Y	Y	Y	N	N
29	RBL Pay	RBL		Y	Y	N	N	Y	Y	Y	Y	N	Y	N
30	SBI Pay	SBI	SBI	Y	Y	N	N	Y	Y	Y	N	N	N	N
31	SIB M-Pay	South Indian Bank	Paymate	Y	Y	N	N	Y	Y	Y	Y	Y	N	N
32	SplitKart	Yes Bank	SplitKart	Y	Y	Y	N	Y	Y	Y	Y	Y	N	N
33	Tranzapp	TJSB Bank	Finacus	Y	Y	N	N	N	Y	Y	N	N	N	N
34	Uco UPI	UCO Bank	LCode	Y	Y	N	N	Y	Y	Y	Y	N	N	N
35	UPI App	Union Bank	FSS	Y	Y	N	N	Y	Y	N	Y	Y	N	N
36	United UPI	United Bank	FSS	Y	Y	N	N	Y	Y	Y	Y	Y	Y	N
37	Vijaya UPI	Vijaya Bank	FSS	Y	Y	N	N	Y	Y	N	Y	Y	N	N
38	Synd UPI	Syndicate Bank	FIS Global	Y	Y	N	N	Y	Y	N	Y	Y	N	N
39	PayWiz	IDBI Bank		Y	Y	N	N	Y	Y	Y	Y	Y	Y	N
40	KVB Upay	KVB		Y	Y	N	N	Y	Y	Y	N	N	Y	N
41	Merai Mobile	ICICI Bank	ICICI	Y	Y	N	12 Language	Y	Y	Y	Y	Y	Y	N
42	LVB UPaay	LVB		Y	Y	Y	N	Y	Y	Y	N	N	N	N
43	Samsung Pay	AXIS Bank		Y	Y	N	N	Y	Y	N	Y	Y	N	N

FUTURE INNOVATION

- ❖ Aadhaar Enabled Payments System (AEPS) – This will allow users to authenticate payments

using biometric information like fingerprint that will be verified against the Aadhaar database and your linked bank account. This could eliminate the need to even use your smartphone for authentication.^{[11][12]}

- ❖ Aadhaar Payments Bridge (APB) – Remittances can be made to an Aadhaar number without providing other details. This would help with direct remittances of government subsidies and direct benefits.
- ❖ Micro-ATMS – Withdrawal of money without the use of a card.
- ❖ Bill Splitting – Bills can be split between different parties instantly.

CONCLUSION

Unified Payments Interface (UPI) is a system that powers multiple bank accounts into a single mobile application (of any participating bank), merging several banking features, seamless fund routing & merchant payments into one hood. UPI is a payment system that allows money transfer between any two bank accounts by using a smart phone. UPI allows a customer to pay directly from a bank account to different merchants, both online and offline, without the hassle of typing credit card details, IFSC code, or net banking/wallet passwords. The interface has been developed by National Payments Corporation of India (NPCI). It aims to simplify and provide a single interface across all NPCI systems besides creating interoperability and superior customer experience. The UPI seeks to make money transfers easy, quick and hassle free. The proliferation of smart phones, the availability of an online verifiable identity, universal access to banking and the introduction of biometric sensors in phones will proactively encourage electronic payment systems for ushering in a less-cash society in India.

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