Acceptance Towards Digital Payments and Improvements in Cashless Payment Ecosystem

Rahul Gupta
Computer Science Engineering Department
Delhi Technological University
Delhi, India
rahulgupta100689@gmail.com

Cheshtha Kapoor
Computer Science Engineering Department
Delhi Technological University
Delhi, India
cheshtha.kapoor10@gmail.com

Jayesh Yadav
Computer Science Engineering Department
Delhi Technological University
Delhi, India
jayeshyadav2004@gmail.com

Abstract- "Faceless, Paperless, Cashless". 'Digital India' is a flagship programme of the Government of India that envisions India as a digitally empowered knowledge economy. As India emerges a global competitor in innovative population-scale payment systems, various digital payment methods have been introduced nation-wide, including Micro ATMs, Banking Cards, Internet Banking, UPI (Unified Payment Interface), Mobile Banking, and Mobile Wallets. However, the Indian economy identifies an unapparent barrier between the growth of Digital India and complete acceptance towards Digital Payment System. India's present usage of cash as a payment mode can be measured in the terms of India's cash to GDP (Gross Domestic Product) ratio of 11.4 percent, as of 2019, which is considerably higher than several other developing and developed countries. This also includes costs of cash, such as costs of printing, maintaining cash supply to ATMs, incurred interest and costs due to counterfeit currency, which round up to 10 to 30 percent of India's GDP. This research studies prior literature and consumer behaviour via ground-level surveys and interviews. We also analyse the cryptic challenges faced by users belonging to different age groups towards complete acceptance of digital payments and modes. For instance, a significant proportion of digital users are minors which spurs the need of shared wallets to allow governed transactions by dependent users. Also, symmetric inter-app transactions, intelligent resolution for effective redressal, credible incentivisation, short-term loans, etc. are proposed. As an outcome, a more reliable, secure, and contemporary working model for a Digital Payment Wallet service using Blockchain Technology has been developed.

Keywords- acceptance, cash, cashless, economy, digital, payment, privacy, security, blockchain, mobile wallet, shared wallet

I. INTRODUCTION

With a foresight to make Indian economy less-cash based and eventually cashless, Indian government has been taking several encouraging measures to augment the concept of digital payments, for example, Digidhan Abhiyaan, Aadhar-enabled Payment System (AEPS), PM Jan-Dhan Yojana, BHIM (Bharat Interface for Money), PayGov India, and many more [1]. However, considerable gaps still persist in the Indian Payment System. Out of 121 crores Indian population, only 44 crore people had a bank account (% age 15+ i.e. 53.1% people) as of 2014 [2]. In 2017, India's population rose to 133 crores and the number of citizens having a bank account (% age 15+ i.e. 79.9% of people) increased to 106 crores [3]. However, having a bank account does not ensure Digital India. In 2014, only 22% of citizens of age 15 years and above had a debit card which slowly increased to 33% in 2017 [2]. Furthermore, the percentage of people who used a mobile phone or internet to access a financial institution bank account was only 5% as in 2017 [2]. And, only 2% of the Indian population, that is, approximately 3 crore citizens of India have a mobile bank account [3]. Moreover, only 28.7% of all payments made in year the 2017 were made using digital payment modes [3].

The following study has been performed to strongly understand any cryptic reasons and also, the trend of hesitant behaviour of citizens belonging to different age groups for either not enabling or not actively using digital payment modes (for either small or large transactions) and also, to understand the drivers that may trigger them towards digital payment modes' enablement. The study involves secondary research on previously published research papers and reports on the e-Payment Ecosystem in India by the Ministry of Finance, Government of India, VISA and Boston Consulting Group & Google. This develops an understanding of the rising questions upon India's development towards a digitally-abled nation. Hence, the initial objectives of this research are to study and analyse the acceptance trend of citizens belonging to different age groups, in the areas of Delhi NCR, India, towards payments made through digital transaction modes. While observing some conventional as well as intriguing trends, we come across several enigmatic quantitative and qualitative insights of user responsiveness towards digital payment modes. Next, the official Terms and Conditions (T&Cs) of various payment apps, including, Paytm, Google Pay, PhonePe and BHIM UPI, are studied to cross-examine user experience. The set of cryptic facts and inferences from the study are presented thereon. In all, several brainstorming sessions and practical experiments on digital transactions lead our study towards possible improvements that ought to be made in the operation of the Digital Payment System to achieve a cashless economy.

As an outcome of the study, a well-defined strategy along with a working decentralised app using Blockchain technology and Smart Contracts has been designed to implement a contemporary Digital Wallet Service that overcomes inferred limitations, for example, enhanced security, effective authentication, simpler transactional protocols, shared or common wallets and decentralised information architecture. Here, Blockchain-based Wallet Payments involve cryptocurrency transactions following a defined protocol standard. Also, existing shared wallet services, for example, Amazon Household and Airtel- One Home One Bill are analysed comparatively to study how Blockchain-based Digital Wallet System is better for the growing and emerging technological economy. Lastly, the conclusions and scope for further study are discussed.

II. LITERATURE REVIEW

Ministry of Finance, Government of India reported the Medium-Term recommendations to strengthen Digital Payment Ecosystem, devised to reduce the cash to GDP ratio from about 12% to 6% [4]. Through complete financial inclusion, Digital India promises access to formal financial services and benefits from e-commerce, uniformly to all. The study also aims to curb tax leakages, funding of criminal activities and costs of cash. The prime recommendation was to adopt digital payments among all government transactions. On parallel lines, Boston Consulting Group and Google [5] suggested that any case where cash appears cheaper than digital transactions must be corrected through government regulation. The committee believes that customers prefer payment modes that are most prevalent and merchants prefer payment modes that drive customers to them. Therefore, adoption of digital payments by customers and merchants are equally important. VISA's report 'Accelerating the Growth of Digital Payments in India: A Five-Year Outlook' [6] states that a cash-intensive supply chain constraints merchants to maintain a certain cash balance and such a high intensity of cash use ultimately results in preference for cash payments. Furthermore, US-based patents 'Shared electronic wallet with permissions' by Eric Barbier [7] and 'Shared mobile wallet' by David M. Grigg, Alicia C. Jones, Marc B. Keller, Patrick Brian Kelly, and Elizabeth S. Votaw [8] outline the idea of permission-based shared wallets to allow governed payments. 'SWAPEROO: A simple wallet architecture for payments, exchanges, refunds, and other operations'- a publication by Neil Daswani, Dan Boneh, Hector Garcia-Molina, Steven Ketchpel, and Andreas Paepcke [9] proposes an extensible, symmetric (common management interfaces through end-user, vendor, and bank), non-web-centric, and client-driven digital wallet architecture for modern payment systems.

III. METHODOLOGY

The methodological approach for initial objectives of primary research and analysis includes an amalgam of quantitative surveys and qualitative interviews among digital users of various age groups; for categorising, generalising and identifying underlying patterns in the partially accepting behaviour of users towards digital payment modes. We called for reliable responses of digital users from Delhi-NCR and the data have been acquired anonymously. Please note, profiling has been carried out on the basis of the age group that a certain individual belongs to. To validate the trend obtained, India's Financial Inclusion Data [3] and The Global Findex Database [2] by The World Bank has been referred.

Lastly, to strategise and develop a working software application of a contemporary digital wallet service, Blockchain Technology has been used. The intelligent program logic, Smart Contract, has been coded using Solidity programming language. The contract has been deployed on an Ethereum Blockchain network and simplified transactional protocols have been implemented. Smart Contracts act as an intermediary to facilitate and verify transactions and are developed using the Truffle IDE and deployed on the Ropsten Test Network. These also act as a pipeline to the Ethereum Blockchain network. The front-end of each account created on the Smart Contract is presented using Metamask (a Chrome Extension), providing information about current ether (cryptocurrency) balance and transaction history of that account. As a result of the deployed transactional protocols, the concept of a shared wallet has been implemented wherein authentic primary wallet-holders (adults) are able to restrict and review the transaction patterns of minors (digital users of age less than 18 years) linked to the primary's current wallet.

IV. SURVEY AND TREND ANALYSIS

To understand user experience and challenges towards digital payments, following graphical analysis has been performed to study the relation between age of digital users and factors influencing the growth of digital economy.

As observed from the age distribution donut (Fig. 1) majority of digital users are citizens belonging to the age group of 18 to 35 years. Citizens of age 35 years or above utilise digital payment services the least due to little technical expertise. Notice, that despite 3 out of 4 digital payment apps (from Table 1) specify the age limit of at least 18 years to use digital payment services, approximately 14.91% of digital users are children belonging to age 18 years or less (minors). It was also observed that among users of age less than 18 years, approximately 83% use either their guardian's bank account or a joint account with guardian for accessing digital gateways. In several cases it was found that minors may also use the mobile number and authentication details of the guardian to avail digital payment services.

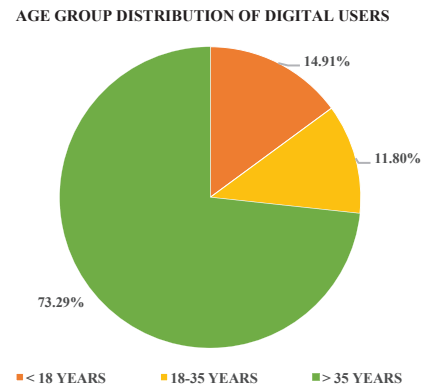AGE GROUP DISTRIBUTION OF DIGITAL USERS

Fig. 1.   Age group distribution of digital users surveyed

The 3-D column chart (Fig. 2) represents the relationship between the years of use of digital payment apps and whether KYC has been completed. Few digital users have been operating digital payment services for more than six-seven years. This implies that digital payments have risen to trend only in recent years. Also, a large percentage of users (65%) have obtained e-KYC or complete KYC only after 2016 Demonetisation that made KYC mandatory for existing and new users. Moreover, a significant section of digital users operates only on e-KYC or no-KYC. Reasons include lack of awareness of the added benefits of complete KYC, ability to pay for majority of the transactions by only having done e-KYC, and the hassle in obtaining complete authentication by visiting a KYC center or scheduling a home visit by a KYC executive.

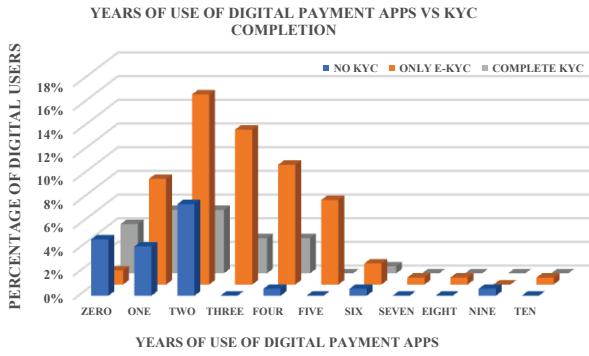YEARS OF USE OF DIGITAL PAYMENT APPS VS KYC COMPLETION

Fig. 2.   Years of use of digital payment apps vs KYC completion status

From Fig. 3, we observe that fraud and security is a rather infrequent issue, whereas, the issue of inconvenient and slow procedure is frequent. On the other hand, the issue of incomplete transaction on one or both ends generally occurs 1-5 times a month due to server-side connection loss or user-side connection issues. For all these issues, frequency increases gradually with the increase in the magnitude of the transaction amount. We infer that a larger transaction takes larger processing time, and this may result in the transaction to time-out or be more susceptible to fraudulent attacks. Also, lack of customer support is a regular issue and a significant improvement in resolution techniques is needed.
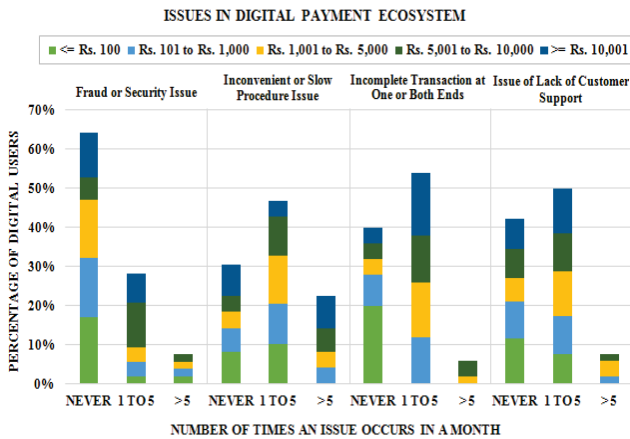

ISSUES IN DIGITAL PAYMENT ECOSYSTEM

Fig. 3.   Issues in Digital Ecosystem

The 100% stacked bar chart (Fig. 4) represents the relationship between age and the overall experience of digital users. The majority of users in each age group have highly rated their digital payment experience by giving 3, 4, or 5-star rating. These experiences can be improved further by focusing on factors that may encourage digital users towards larger acceptance of digital payment modes. Digital users of age less than 35 years are aware of modern technology and digital environment. They tend to use digital payments for numerous daily activities and hence, desire a simple, quick and convenient procedure. Also, following the frequent transactions made by users of this age group and the larger amount transactions made by users of age greater than 35 years (for example, fees and jewelry), increased security and shared wallet innovation is a major concern.
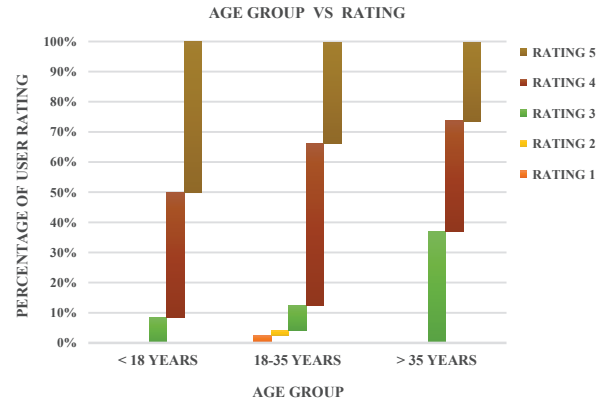

AGE GROUP VS RATING

Fig. 4.   Relationship between age groups and experience ratings

V.   DIGITAL PAYMENT APPS

From survey and analysis, we observe (Fig. 5) that the most prominently used mobile payment apps are Paytm (85.9%), Google Pay (68.1%), BHIM UPI (42.3%) and PhonePe (41.7%); while other apps being serviced include Freecharge, Paypal, Mobikwik, etc. The age limits in regard with the terms and conditions of the four most-prevalent digital payment apps [10]-[14] are shown in Table 1.
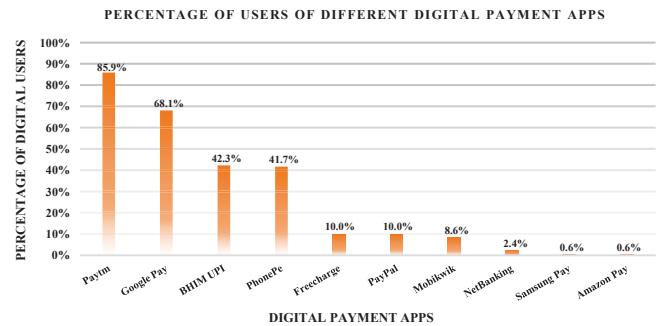

PERCENTAGE OF USERS OF DIFFERENT DIGITAL PAYMENT APPS

Fig. 5.   Percentage of Users of different digital payment apps

TABLE I.   COMPARISON OF AGE LIMITS IN DIGITAL PAYMENT APPS

	Paytm	PhonePe	G Pay	BHIM
Minimum Age Limit	18 years	18 years	18 years	Anyone with bank account

Legend: Negative   Neutral   Positive

VI.   RESULTS AND FINDINGS

We now attempt to examine existing as well as discovered trends for the partial acceptance of citizens towards digital modes of payments.

- *Ease of use:* The complex nature of transaction protocols and app manoeuvring confuses technically advanced youngsters, let alone elderly citizens and uneducated merchants. Digital services these days are innovating and increasing functionalities at an exponential rate, especially to maintain safety and security. This is not

3

parallel to the slow increase in literacy rate and awareness. A technologically advanced user-friendly digital payment service shall be one whose operations are illustrious, vernacular and with simple and defined manoeuvring for even the less-technical users while ensuring immense security and privacy. In addition, two-factor authentication (UPI Pin and Biometrics), insulated with stringent time-outs, should be employed to ensure standardised simplicity and security across all platforms. Moreover, biometrics can be used for every subsequent access to the app. Here, the previous app/transaction state will be disabled if the app is closed for a designated time-out.

- *Privacy and Security:* KYC (Know Your Customer) was a service introduced after 2016 Demonetisation to authenticate users. Until then, any user with a mobile number linked to a bank account could use all forms of mobile payment services. Even today, several mobile services that provide bank to bank money transfer using UPI do not require KYC, only a mobile number linked to a bank account. KYC is now required only for Digital Wallets. E-KYC or electronic KYC can be performed at home on the mobile device itself. However, complete KYC is required to access full functionalities of any digital payment service and must be performed at a KYC centre by visiting physically or scheduling the visit of a KYC executive. This makes the digital payment service a little less digital. Therefore, provisions for accomplishing complete digitisation at both user and administration end must be undertaken (using more secure identity verification services). Also, regular onboarding and awareness missions via public-private-partnership of the government and the service providers can be conducted in a manner of localities.

- *Network and Speed:* With the internet becoming cheaper, high-speed network and internet distribution have expanded. However, the effectiveness of the working internet is at its low. Digital payment users often face slow internet connection issues which prevent them from using or relying on uniform digital payment services. By increasing the bandwidth and introducing a provision for carrying out a transaction under slow internet connection, several network and speed issues can be eliminated. For example, Google Pay (formerly, Google Tez) has employed a transaction strategy where digital payments can be carried out in one-touch by bringing the sender and receiver mobile devices in proximity. The same scheme may be enhanced to carry out small transactions using Bluetooth or a slow internet connection.

- *Resolution and Redressal:* Server issues can cause time-out errors. This may result in either the transaction happening twice or an unsuccessful transaction on one or both ends. Such inconveniences when combined with ineffective customer support and large user base, force users to prefer cash transactions. Common issues, for example, mobile recharge transactions in Paytm, ought to be analysed automatically to maintain atomicity and the most recent consistent state. Also, effective

resolution using functional chat-bots must be incorporated.

- *Incentives:* Services like e-commerce, transport, retail, food ordering, etc. grant incentives to promote digitisation. However, as the prevalence of Digital Services has increased, absolute incentives have decreased. Simple cash-backs and lucky draws are not enough to attract more users. Users desire confirmed incentives, in money-form or in kind, to adapt to changing digital society. Also, services must ensure direct automatic transfers, necessitating certain kinds of transactions to be made digitally only.

- *Merchant Adaptation:* Merchant population in India constitutes mainly of small merchants (with annual revenue of less than 20 lakhs). With limited awareness regarding benefits of digital payments and little technological know-how, small scale businesses are not fully adapted to digital payment modes from customers. Suppliers demand money from merchants in cash. Also, merchants have a daily livelihood pattern. As customers ask for digital payment options, a small merchant may accept money into his digital wallet or bank account, but is forced to withdraw cash from the ATM to pay his supplier or buy his ration on a daily-basis. Amidst this, a 5% charge for transfer of balance from wallet to bank account is unfair to them. Moreover, a merchant runs in the fear of losing the little he has earned into transaction failure or fraud. One of the known reasons for excessive cash transactions is the ability to transact in black without showing actual earnings and exempt from taxes. Unless merchants receive technical education, effective customer support, low interest rates, high rewards and incentives, and a proper understanding of the various benefits of transacting digitally (like convenience of not having to store and manage cash, to be able to track daily transactions, possible tax benefits, etc.), a part of the supply-chain shall remain un-digitised.

- *Peer to Peer Connection:* Citizens feel it as a struggle to carry around cash or cards. Hence, digital payments are more convenient. However, with increasing kinds of service providers, many users find themselves torn between which mobile app to use to be able to connect with all of their peers and merchants. For example, Paytm Wallet users can only send wallet money to other Paytm Wallet users. Therefore, a coalition of these mobile apps must be formed such that the user of one app is able to transact with another user using any other mobile app. This can be achieved with the use of unique app-specific Wallet IDs (similar to UPI ID for bank-to-bank transfers).

- *Transactions made by Minors:* From Table 1, we observe that citizens below the age of 18 are legally not allowed to transact digitally using 3 out of 4 apps. However, survey analysis (Fig. 1) depicts that approximately 14.91% of digital users are minors, majority of whom have a smartphone, government-issued identification documents and a bank account. This bank account may be their own, their parents' or a joint account of minors with their guardians. Before

4

demonetisation and KYC introduction for digital payments, minors could easily use any of the digital payment apps to make peer-to-peer or customer-to-merchant transactions, which required only their mobile number linked to their bank account. Even now, bank-to-bank UPI money transfer does not require KYC and minors can transact easily- although it may not be legally permitted. On the other hand, Wallet Services require KYC. E-KYC can be easily done by minors on their mobile devices. Here, they may input the adult guardian's KYC details and begin using digital payment services. The service providers do not verify if the KYC details entered for e-KYC are of the user or their guardian. This is only verified when a minor visits a KYC centre to complete his/her KYC. Ultimately, a minor cannot complete his/her KYC to enjoy full functionalities of digital payment services. Due to the rising acceptance of digital payments by citizens of all age groups, India cannot afford to let a major part of its population remain undigitised. Therefore, users, especially minors, should not be forced to find loopholes in order to be able to transact digitally. As a proposal, hence, we recommend the innovation of shared/common wallets. Here, a family will be able to form a shared wallet. Each member of the shared wallet group will

- require a smartphone and mobile number along with complete e-KYC. The adult guardian(s) or admin(s) of the group will be allowed to transfer money between shared wallet and linked bank account (to and fro) and set an upper limit on the amount of each transaction by any member of his/her group. The notification of each transaction made by any of the members shall be distributed to every other member and anybody shall be able to review the e-statement of transactions made thus far. This shall enable regular monitoring of digital transactions done by minors, by their guardians. Also, the concept of a shared wallet can be extended to a group wallet for peers.

In total, a simpler transactional protocol, secure yet clear authentication of users, efficient customer support, and a user-friendly mobile digital payment service will help India take a step closer to becoming a cashless economy. Other functional improvements are stated in Table 2.

VII. SHARED WALLETS

A shared wallet is a proposed, multi-signatory, contemporary digital wallet service where a wallet account is accessible to more than 1 persons. Here, the primary objective of the shared wallet is to allow minors (children below the age of 18 years) to legally transact under the guided supervision of guardian(s) or parent(s), subject to restrictions imposed. Following are few other important roles of shared wallets.

1. *Common space for transactions and consistency:* One or more participants (primary users) can add money to the shared wallet, while all primary and allowed dependent participants (as controlled by the primary of the shared wallet) can transact using shared money. Also, transactions made by one participant reflect in the mobile accounts of all other participants.

2. *Accounting and transparency:* All participants (or only certain participants, as controlled by the primary of the shared wallet) can access the transaction history and track the trend of money inflow and outflow.

3. *Constraints on minor transactions:* A primary user is capable of issuing restrictions on transactions made by a dependent participant of the shared wallet, for example, spending limit, kind of product, time of day, location, etc.

4. *Third-party mediation and availability:* If a transaction is rejected by the admin of the gateway due to violations of constraints put on by the primary on dependent participants, the primary is notified and is asked to explicitly grant or deny permission.

5. *Security:* If a transaction requires consent of some or all of the participants, any suspicious transaction being made by a malicious user can be denied from the devices of other participants in the shared wallet.

TABLE II.   ADDITIONAL FUNCTIONAL IMPROVEMENTS/REQUIREMENTS FOR DIGITAL PAYMENT SERVICES

S. NO.	DESCRIPTION	RATIONALE	PRIORITY
I.	Data acquisition, storage and sharing	Policy changes to prevent user data being acquired or stored without user permission or shared outside the organisation or nation, for monetary profits.	Future
II.	Money and budget tracking	Intelligent trend analysis, fully controlled by the user.	Low
III.	Short-term loans	Loans granted at nominal interest rates for limited amounts and terms, returns to be made digitally. Example, LazyPay.	Future
IV.	Reliable and faster satellite-based transactions	Similar to 'One-Touch Pay' in Google Pay. Transactions using AirDrop or Bluetooth between devices in proximity in absence of strong network.	Low
V.	Dissolution of physical factors	Decrease in the spread of ATMs and cash-on-delivery systems.	Medium

Although shared wallets have vast benefits, it is a rather new methodology in the market. Amazon.com Inc. and Bharti Airtel are amongst the top digital service players that support the implementation of shared wallets in different forms.

Airtel Home- One Home One Bill [14] is a service that bundles multiple Airtel connections into a single account that is manageable via My Airtel App. You can pay unified or individual bills from the primary account using the unique authentication mPIN in the internet-based My Airtel App. USSD technology allows GSM-based phones to communicate with Airtel's server without internet or smartphones, enhancing the financial inclusion of underbanked and economically weaker sections. Moreover, a bank account or minimum wallet balance is not mandatory.

Amazon Household [15] is an Amazon Family service which requires at least one out of two adult members to have an Amazon Prime Account to share Prime benefits with members of their household. Children (less than 12 years old) and teens (13-17 years old) can access digital content like, games, apps, movies, music, photos, eBooks, etc. on their devices. Parent(s) can manage the content accessibility by controlling which content is to be shared and with whom. Unlike children, teens may connect their individual Amazon accounts to the Household and can shop under parental approval. Parents can also select delivery addresses, payment modes (details of which are visible only to parents) and spending limits.

Amazon Family allows only up to 2 adults into the household account, while a household, in general, may have more than 2 adults in the family and still require a shared account. Also, it is necessary for the adults in Amazon Household to share their personal payment details with other adults in the household. It is justifiable, however, not viable from a privacy point of view. Airtel Home, unlike Amazon Household, only allows transactions performed by the primary account holder. For Airtel Home, one must have an Airtel SIM postpaid connection. Moreover, transactions once initiated cannot be aborted, which results in lack of real-time failure resolution.

We find that shared services are operated in almost every e-service, in one form or another. However, our aim is to propose a working model where shared e-wallet is used primarily to support transactions made by minors under the supervision of their parents. Therefore, a rather secure and contemporary transaction technology, Blockchain has been used to develop the projected model.

VIII. Shared Wallets Using Blockchain Technology

Blockchain is one of the most innovative technology to secure a digital transaction. A blockchain is a chain of electronic blocks that contain encrypted records of transactions in a distributed manner. These blocks are shared and synchronised across multiple peer-to-peer nodes, geographies and administrative domains. Moreover, in public blockchains, any computer on the internet can join the network. Whereas, in private blockchains, only identified or known members are allowed to join the network (similar to KYC in digital payment system).

Blockchains do not have a central point of failure and cannot be changed by a single node. It requires a massive amount of computing power to alter all distributed replicas of the record. In addition, network participants have their own private key which acts as a Digital Signature for the record/transaction it makes. So, if any of the record/block is altered, the Digital Signature will deem invalid and an attack will be detected. Also, blockchains permit transactions to have public witnesses and to transact without a middleman to make digital transfers more reliable, secure and free from cyberattacks. Online transactional data are becoming Big Data, which means service providers have exponentially more information to be processed in real-time. Blockchains, thus, can be used to provide direct, lightning-fast communication and management of money and data.

In this study, a working decentralised application model has been developed that implements enhanced security, shared wallet and distributed ledger architecture in modern-day digital payment systems.

The methodical procedure adopted for the development of a fully functional decentralised app (d-App) for shared wallet services using blockchain is described below.

1. Problem statement designed

All necessary logic requirements, edge cases, and consistency conditions were defined.

2. Development of the Smart Contract on Remix IDE

Smart Contract (program logic consisting of functions and requirement conditions that are to be met to carry out a successful transaction) was developed on Remix IDE and deployed on Ethereum network. The generic logic contract constituted of several functions like *"make transaction", "add owner", "transfer to"* to make transactions, add more than one participant to the wallet, transfer ethers from a given wallet to the correct destination etc. Constraints like age of transacting party, transaction amount, etc. were also integrated.

3. Deployment using Truffle and Atom

Truffle IDE and Atom were used to create a migration pipeline linking the Smart Contract to the Ethereum world using *"truffle_migrate"* command on the terminal.

4. Deployment on Metamask

The deployment of designed shared wallet was done in Injected Web3 environment using the Web3 provider embedded in the web browser. The developed contract was then deployed on Ropsten Test Network, allowing us to receive, send, notify, and check the amount of ethers transacted. The front-end of the d-App was prepared and run on Metamask to carry out transactions on a regular browser.

5. Transaction processes carried out on Ropsten Test Network, initialised by adding ethers via Ropsten Test Faucet

Once the Smart Contract was deployed on the Ropsten Test Network, to initiate and support the transactions, gas values were needed (threshold amount of ethers that will be consumed while updating all the nodes of the network whenever a transaction is carried out). To make ourselves capable of supporting trial transactions, sufficient amount of

ethers were added to make a transaction. Adding ethers to the wallet is done using Ropsten Test Faucet, which adds required amount of ethers into the account using account address.

The various cases and outcomes of the activity of the developed blockchain application are discussed below.

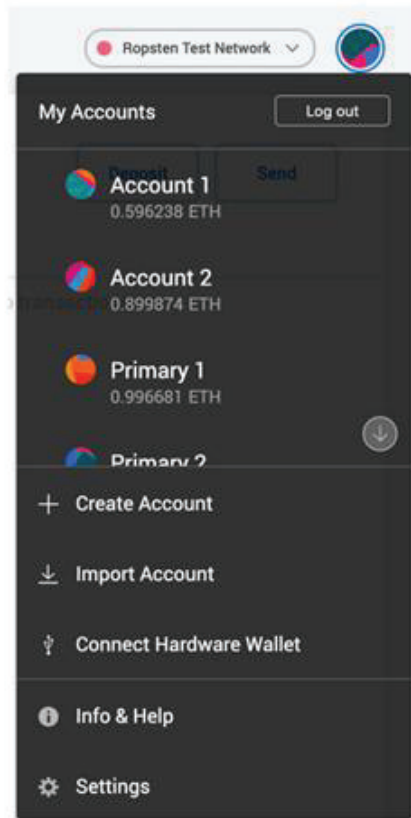1. *Creating an account* to deploy the Smart Contract as depicted in Fig. 6.

Fig. 6. Create new account on Ethereum Blockchain network

2. *Adding initial ethers to an account:* From Ropsten Test Faucet, we transfer 1 ether to the user account created (to be used for payment of gas price and transactions outside the shared wallet smart contract) by mentioning the account address.

3. *Generic transfer of money from one primary account to another*

Step 1: We can transfer funds from one wallet to another by providing the primary account address and the amount of transaction to "*transferTo*" function.

Step 2: Primary receives the notification for confirming the transfer of funds.

Step 3: When the transaction is confirmed, funds are successfully transferred, and wallet balance is updated suitably (Fig. 8).

4. *Adding new participant (primary or minor digital user)*

Step 1: Once the primary account deploys the shared wallet contract on Ropsten Test Network, it becomes the primary owner of the wallet, and as a master, can then add other accounts, whether a primary (adult) or minor account.

Step 2: Primary 1 can add another primary account, Primary 2 by calling the function "*add_owner*" in the backend, using the address of the Primary 2.

Step 3: This will send a request to add 'Primary 2' to the other primary users of the shared wallet. If accepted, Primary 2 is successfully the added owner of the shared wallet (Fig. 9).

Similarly, for creating a minor account, we call function "*age*" and then "*add_owner*" one after the other. If the mentioned age is below the age of 18 years, all primary users can monitor and control the minor's transaction (Fig. 7).

5. *Checking Wallet Balance*

Current wallet balance can be checked by calling "*wallet_balance*" function in the backend of Remix IDE. This will return the number of Wei in the wallet (Fig. 7).
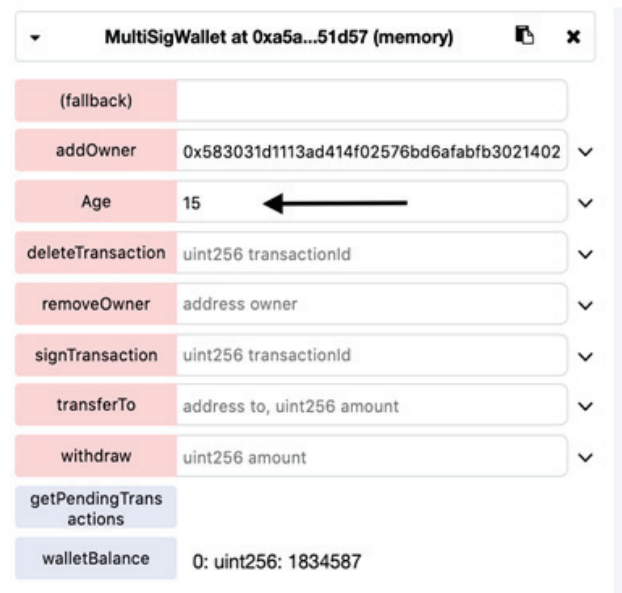

Fig. 7. Successful addition of new minor into the shared wallet

6. *Viewing transaction history/log*

Any account can access the transaction history of its primary or shared account by simply clicking on a transaction. From a small description, one can go to "Etherscan" to see details, like, transaction hash, status, block, timestamp, account addresses (from and to), value, gas price, nonce, etc.

7. *When a minor performs a transaction for an amount less than the spending limit*

When a minor makes a transaction below the spending limit (set by the primary of the shared wallet), the transaction will be completed implicitly (Fig. 8), and the primary account will only be notified about the transaction details.

7

8. When a minor performs a transaction for an amount greater than the spending limit

When minor account makes a transaction of amount greater than spending limit, primary account receives an alert to grant or decline permission. If permission is granted, the transaction is completed (Fig. 8) as in the case of a transaction below spending limit. Else, if declined, the transaction is reverted (Fig. 9), and the shared account is brought back to the most recent consistent state.
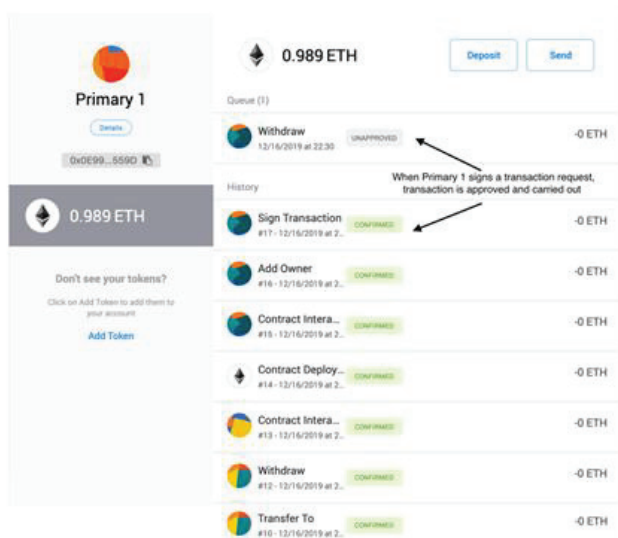

Fig. 8. Primary account after minor's withdrawal below the spending limit
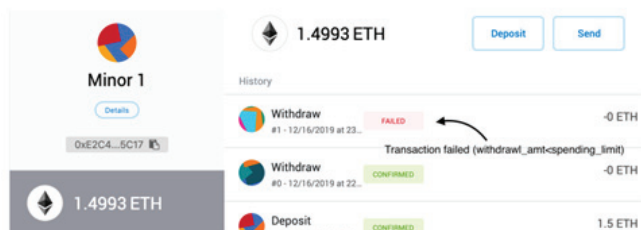

Fig. 9. Transaction failed for amount greater than spending limit

IX. CONCLUSION

Indeed, the road towards complete digitisation is long. And India is moving in the right direction, at a commendable pace, along with the right motivation from the Government. The Indian government is undertaking stringent measures to promote digital payment services, for instance, the Data Protection Bill 2019. A recent initiative as of 2019 is FASTag- A digital service that mandates tolls to be paid digitally. However, while pacing up with everyday advancements, one often neglects parallel factors that slow India's digital growth by a significant rate. The fundamental objective of this study was to determine possible, yet inexplicable factors slackening complete digitisation and to discover feasible solutions that can generate improvements in a potential cashless ecosystem.

Apart from noncryptic facts, like, poor network and connectivity, ineffective security and support, we find that a significant population of minors (users below 18 years of age) transact digitally, although they may not be legally allowed to do so. We see that KYC authentication is not yet

mandatory at all digital platforms, and at platforms where it is, the procedure for KYC completion is not entirely digital. Also, additional fees for making wallet-to-bank transactions, partial acceptance of digital payments by merchants, unreliable processes, and the complex nature of navigation and transaction protocols, etc. cause a reduction in digital customer base. As an outcome of these findings, an improvement scope has been discussed wherein several advantageous suggestions have been made, including, digital biometric authentication, coalition of various digital payment platforms, implicit redressal, shared wallets, etc. With a concerned focus on absorbing the teen population as regular digital users, we propose an e-wallet service based on Blockchain technology that implements easier use, enhanced security, decentralised network of transacting nodes, and shared wallet. In our blockchain-based shared wallet system, only a primary can create the account of a dependent user, while fully controlling the spending limit. The primary is notified of every transaction in or out of the shared wallet and the transaction history is transparent to all participants. Implicit consistency and effective security are maintained in the projected model.

X. FUTURE SCOPE

Although the technology of blockchain is relatively simple, more effective, and highly secure, its implementation without the use of cryptocurrency is trickier. Blockchains incorporating cryptocurrency, like, Bitcoin or Ethereum, can work towards boosting a nation's economic growth. Here, we recommend a capable model for advancements in the existing digital payment system. Nonetheless, a vast scope lies beyond this study. Studies on acceptability of parents and teens towards shared wallets, operability of inter-app transactions, exploitation of confidential transaction information, applicability of short term loans, innovations in use of biometrics for reliable authentication, necessary user-oriented policy changes essential for India's growing economy, including capping MDR rates for merchants, protection and localisation of user-data, and regulations for minimum e-KYC constitute the future scope of this study.

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