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Secured and Efficient Payment Gateways for eCommerce

Jay Patel

G H Patel College of Engineering & Technology, Bakrol Road, Vallabh Vidyanagar, 388 120, India.

A B S T R A C T

With the rise of various payment methods, India's digital payment ecosystem is booming. By redefining service by introducing tactics like UPI, IMPS, e-KYC, and Aadhar as an authentication mechanism, the Government has helped to fintechs' growth. To put it simply, the purchase of products and services via various electronic means results in digital payment. This paper describes the growth of various payment gateways and e-wallets in India post-covid-19 by providing some basic information about the payment gateway, its process, and its benefits and limitations by using such a type of electronic payment mode. This paper mainly focuses on providing a comparative study amongst some of the best payment gateways and e-wallets currently present in the country using a set of parameters that affect the performance of a payment gateway.

Keywords:Payment Gateways, Covid-19, Digital Payment, e-wallets,

1. Introduction

India's digital payment market has seen a significant increase since COVID-19. In India's domestic ecosystem, the diverse payment networks are constantly changing and diversifying. Robust digital payment networks are emerging to keep up with fast-changing technologies. COVID-19's modern standard, social distancing, has affected not only customer buying habits, but also how they pay for goods. Local and emerging companies, such as online storefronts, energy bills, and so on, are accepting digital payments as a part of the government's Digital India program.Digital payment adoption is now very well entrenched in India. One-third of all households use it in some way or another. It's refreshing to see that about a fifth of households in the bottom **40%**[1]of income bracket use it as well, suggesting that it's no longer all for the affluent or well-educated. In the bottom and middle-income groups**, 15%**[1]of households want to use digital payments.Consumers have a strong preference for digital payments and online banking, which is fueled by a well-developed ecosystem. Consumers may also perceive the benefits and drawbacks of the various digital payment products available, indicating a well-developed market ecosystem.A high-quality drive toward inspiring consumers (rather than extolling product functionality or generalized benefits of digital payments), with clear "how to use" information, learning and problem-solving helplines, and safeguard features that help the consumer "stay healthy," will help India race toward becoming a cashless society. It is now well past the early adopter level, and the majority of users are operating it. What's more encouraging is that the lower income community is already included in the digital transformation. With 25.5 billion[2] real-time payment transactions, India has held the top rank in the globe, followed by China with 15.7 billion. In 2020, India's transaction volume share for quick payments and other electronic payments was 15.6 percent and 22.9 percent, respectively, but paper-based payments had a significant share of 61.4 percent.

2. Secured payment gateways

A payment gateway is a piece of software that collects and sends payment data from customers to acquirers, and then sends payment acceptance or rejection back to the customers. A payment gateway secures the cardholder's information, guarantees that money is accessible, and allows businesses to be paid.In this section, the payment gateway process with some other features and parameters that affect the experience of digital payment is described.

* Corresponding author. Tel.: *+91-9099921613*;
E-mail address: 180110116038@gcet.ac.in

2.1How does a payment gateway work?

Throughout the process, a payment gateway focuses on protecting the confidential details provided by the customer. It guarantees confidentiality by encrypting data provided by the customer, such as credit card and bank account details.
The basic steps of how a traditional payment gateway operates are shown below.

1. A customer places an order and then clicks the website's Submit or Checkout button, or an equivalent button.
2. After that, the website or e-commerce portal directs the user to a payment gateway, where he or she enters all of the necessary details about the bank or card being used to make the payment. The PG then directs the customer to the issuing bank's page or a 3D protected page, where they can authorize the transaction.
3. In response, the payment gateway sends a message to the vendor. If the bank responds with a "No," the dealer then sends an error message to the client, informing them of the problem with the card or bank account. If the bank portal responds with a "Yes," the merchant requests the transaction from the bank.
4. The money is settled by the bank with the payment portal, and then settlements with the merchant.
5. The customer will receive an order approval letter after this procedure is finished.[3]

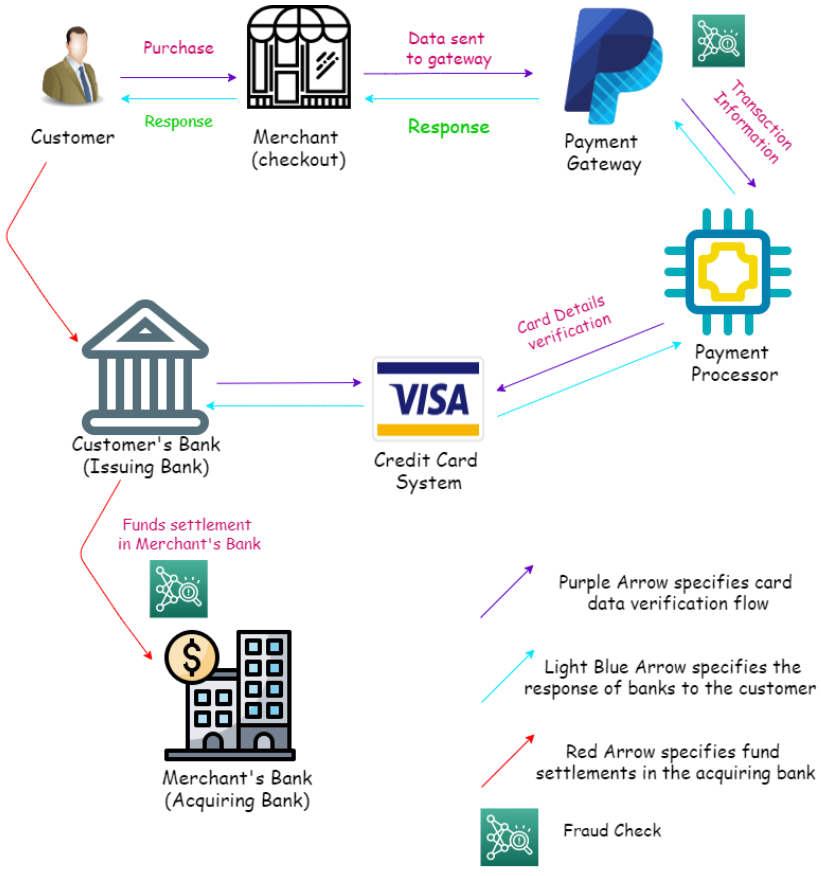

Fig. 1 - Steps in a generic payment gateway process

2.2Benefits of payment gateways

- Secure transaction: The payment gateway verifies and reviews online transfers. It safeguards all retailers and consumers against frauds
- Ease of use: Payment gateways can be used by anyone with a basic understanding of computers to conduct business transactions. There's no reason to invest in expensive courses or master a complicated setup. It's easy and straightforward. It can be used by anyone.
- Rapid Deployment: A retailer may use a payment gateway service for his or her online shop right away. He does not have to wait an excruciating amount of time to complete the payment gateway setup in his business. He will be able to get it as quickly as possible.

- Feature-rich: Online payment gateways have a range of customization that can support both retailers and consumers. Safety settings, payment options, card features, and so forth... You can enable all of these features or just the ones that best serve your type of business. [4]

2.3Limitations

- Personal Information leak: A payment gateway company will keep notes on all confidential customer information, such as addresses, bank statements, credit card numbers, and passwords. Crooked and unethical persons would be more than able to spend exorbitant amounts of money just to get access to this classified material. Payment gateway providers could be able to market this information to third parties without the customers' knowledge.
- Glitches and Bugs: Like any other software, payment gateway might face some glitches while operating with it. When this happens, it can have negative consequences likecustomers can no longer use the internet to access details or make purchases or the website becomes unavailable for merchants. Troubleshooting the issue and restoring merchant websites to normal service would take time—perhaps weeks or months.
- Customer's uneasiness: When conducting online transactions involving the disclosure of personal information, they prefer to avoid using any web-based applications. If a retailer obtains a payment gateway service but its clients refuse to use it for any reason, the merchant would be on the losing end of the deal

3. Parameters / Features to lookout for in a Payment Gateway

Customers have a variety of payment options, therefore it's critical for businesses to have the correct payment gateway. They should seek for a payment gateway that is not only safe but also convenient for clients while picking one.
Here are some characteristics to look for when deciding on a payment gateway for your needs:

3.1 Security

PCI DSS

The Payment Card Industry Data Protection Standard (PCI DSS) is a series of security specifications intended to ensure that ALL companies that accept, handle, store, or transfer credit card data do so in a safe manner.On September 7, 2006, [5]the Payment Card Industry Security Standards Council (PCI SSC) was established to oversee the continuing evolution of the Payment Card Industry (PCI) security standards, with an emphasis on strengthening payment account security in the transaction process.

SSL and TSL

SSL (Secure Sockets Layer)[6] is an Internet authentication protocol that uses cryptography. Netscape introduced it in 1995 as a way to ensure privacy, authentication, and data integrity in Internet communications. SSL is the forerunner to today's TLS encryption standard.Instead of "HTTP," a website that uses SSL/TLS has "HTTPS" in its URL.TLS (Transport Layer Encryption) is a commonly used security protocol for facilitating privacy and data security in Internet communications. TLS version 1.0 was previously established as SSL version3.1, but the protocol's name was changed before it was published to signify that it was no longer affiliated with Netscape.

SSL Certificate

SSL certificates enable websites to switch from HTTP to HTTPS, which is a more secure protocol. An SSL certificate is a data file stored on the origin server of a website. SSL certificates allow SSL/TLS encryption by containing the public key and identity of the website, as well as other information. This file would be used by devices trying to connect with the origin server to access the public key and validate the server's identity. The private key is kept safe and stable at all times.[7]

3.2 Cost

Pricing is one of the most important elements for a business to consider in this profitable economy. For a free payment gateway to exist, there must be complete awareness of the prices that the payment gateway service provider incurs, which include setup, maintenance, transaction discount rates, and more. You gain more from your consumers if you pay your provider less.

3.3 International Payments

The rapid advancement of technology and the widespread use of the internet are pushing organisations to new heights on a worldwide scale. An international payment gateway helps customers to pay in their preferred currency without converting them. It's critical for a company to realise that the cost of taking international payments should be a little fraction of the overall cost of serving clients from other countries. In addition, you'll need a payment method that your overseas consumers recognise and trust.

3.3 Transaction Time

The processing time for a payment might range from 24 hours to three days. The reason for this delay is because the transaction procedure involves several stages in order to transfer funds from one bank account to another. The time it takes for a merchant who accepts a credit card to receive payment until the money are deposited into the merchant's bank account varies depending on the kind of bank account used by the business owner.

3.3 Ease of use

User experience is another factor to look out for in a payment gateway. There are a few basic things to consider like easy-to-use navigation, useful site search, clear design, standard UX, and 24x7 customer service. These components directly impact the way the customers are experiencing while operating the system.

Table 1- Table of comparison of some of the best payment gateways in India

Features	**Security**	**Cost**	**Processing Through International Payment**	**Transcation Time**	**Customer care and support**	**Banks supported**	**Other features**
Gateway/Protocol							
Paypal	security measures include firewalls, --data encryption, --physical access controls TLS 1.2 only connections for logins, PCI DSS compliance identity protection using 2FA	-Free -0 maintenance charges -Transaction Fee/Transaction:4.4% + US$0.30 + Currency conversions charges	--international currency used as the base currency -- supports 57 currencies VISA, MASTER CARD, AMERICAN EXPRESS, EUROCARD MAESTRO	-- Payment transfers immediately. -- However, there are occasions when it may take up to 24 hours. -- No. of days to start a transaction: immediately after registration	online support, multicurrency support,PayPal merchant technical support is ready to assist with integrating PayPal on website	Axis Bank HDFC Bank IDBI Bank ICICI Bank Kotak Mahindra Bank State Bank of India (SBI) Indian Bank	--Debit cards (also known as bank cards) are accepted only if they have a Visa or MasterCard logo. --Currency conversion fee - 2.5% added to the exchange rate -- per transaction limit to USD $10,000
CCAvenue	--CCAvenue uses industry-standard VeriSign's 128 bit SSL Technology to encrypt -- CCAvenue has achieved the PCI DSS 1.1 Standards of Compliance -- F.R.I.S.K engine (Fraud & Risk Identification System &	initial setup fee:0 Transaction costs(Credit / Debit Cards): 2%(domestic cards and debit cards) 3%(international credit cards) Maintenance Cost: 1200 annually	--supports 27 foreign currencies. VISA, MASTER CARD, AMERICAN EXPRESS, DINERS CLUB JCB CARDS CITY BANK ECARDS, DISCOVER NOVUS	Optimum transaction time: The transaction is completed between 30 seconds and a minute. -- No. of days to start a transaction: 3-6 days	real time transaction support, technical support and supports net banking, support 24*7.	Axis Bank HDFC Bank, ICIC Bank, SBI, Canara bank, Union Bank, PNB, HDFC etc.	Live Chat, shopping cart ready, instant SMS, email, Detailed reports

	Knowledge Base).						
DirecPay gateway	1.PCI DSS Certified 2. VeriSign Secure 3.Verified by Visa & Master Card Secure Code	-- Annual maintenance Charge: Zero. -- Transaction Fee per Transaction: variable transaction fee applies Transaction costs: 2-3%	VISA, MASTER CARD DINERS CARD, MAESTRO, AMERICAN EXPRESS	-Transaction status gives response as alert message. --Fast transaction passage --receive alerts via email --money transfer to bank within 2 days i.e T+2 days --No of Days to start a transaction: 5 to 7 days	--one-stop payment gateway solution for merchants --merchant-centric payment gateway service --24*7 support	Axis bank Allahabad bank Bank of Baroda HDFC BOI SBI PNB etc.	Credit cars Debit cards Internet banking Real time MIS T+2 Fund Settlement
EBS gateway	1. Risk Monitoring 2. PCI DSS 3.0 complaint 3.verisign 128-bit SSL Technology 4. Security Firewall Used 5. audited by ISO 27001-2013 standard	0 setup fees 2.00-3.00% transaction rates AMC of Rs. 1200	--Supports 11 major currencies Visa, MasterCard, American Express, Discover JCB	Settlement days: 2-3 days -Transactions on real time	-- risk detection and risk monitoring -- fraud prevention --smooth multiple payment option.	ICIC bank HDFC bank, AXIS bank, state bank of India, Indian overseas bank, corporation bank.	Credit cards Debit Cards International Cards Net Banking Multiple currency acceptance Cash Cards Digital Wallets PayPal Advanced analytics
Paytm	1.PCI DSS compliant in terms of security 2.128-bit encryption SSL security 3.real time monitoring and transaction engine	0 setup fees 0 maintenance cost 0-3% transactions rates	-- Supports 72 plus currencies VISA MASTERCARD	--Transaction processed in real-time. --Beneficiary gets money instantly.	--24X7 IVR & email support for recharge and payments related queries.	AXIS bank HDFC bank ICICI bank PAYTM PAYMENTS BANK etc.	credit, debit cards Recharge and pay bills PayTm mall PayTm for business etc.
PayU	ISO 27001:2013 Certified PCI DSS Certified 128-bit SSL encryption 2 factor authentication	Rs. 4900 setup fees 2-3.0% transaction rates + GST Rs. 2400 AMC charges (payUbiz) Rs. 0 setup and AMC 2%+GST transaction	VISA MASTERCARD AMEX Rupay Diner	money transfer to bank within 2 days i.e T+2 days	Chat support (chatbot) FAQs in website 24x7 support	axis bank hdfc bank ICICI bank SBI bank etc.	cards Net banking UPI wallets Buy now pay later EMI etc.

	Tokenization	rates (PayU money)					
InstaMojo	128 Bit AES Encryption SSL PCI DSS Compliant Tamper Proof Link	2% + Rs. 3 GST transaction rates Annual maintenance Charge: 0	MASTERCARD VISA AMEX	money transfer to bank within 3 daysi.e T+3 days	product or issue related queries career related queries	Standard Chartered Bank YES Bank Bank of Baroda IndusInd Bank HSBC Bank Axis Bank ICICI Bank Kotak Mahindra Bank RBL Bank	Instamojo App Store Convenience Fee Bank Transfer Team Accounts Online Store Domains & Emails Largest MSME
RazorPay	TLS Encryption PCI-DSS Compliance Tokenization 2 factor authentication	One Time Setup Fee: 0 No Maintainance Fee Priority Support Early access to new features 2% Razorpay Platform Fee	Visa, Mastercard, American Express RuPay.	Settlement days: 3 days	track refund status raise a request file a grievance chat and IVR available 24/7	HDFC bank SBI bank Canara bank Axis Bank (total 50+ banks)	-RazorpayX -Razorpay Capital -Thirdwatch cards -netbanking -EMI etc.

4. Literature Review

With the introduction of e-commerce and the rise of the Internet, the payment process became more digitized, with the availability of numerous online payment methods such as electronic cash, debit cards, credit cards, contactless payment, mobile wallets, and so on. Furthermore, mobile payment services are growing in popularity day by day and are demonstrating a transformation by moving toward a promising future of speculative opportunities in conjunction with technology advancements. Burhan Ul Islam Khan et al.[4] aimed to assess the current state and growth of online payment systems in global markets, as well as their future prospects.After analysing many academic papers on online payment schemes, this paper completed a systematic survey on all forms of electronic payment. The numerous factors that influence customer acceptance of online payment systems are also examined in this report. Several online payment system services, as well as the security risks that come with them, have been examined, as well as the future of such payment methods. This study also analyses the different elements affecting the adoption of consumer online payment systems. Moreover, there can be observed a massive increase in mobile payment methods internationally, all thanks to the simplicity and security afforded by both debit and credit card purchases. In acceptance of online payment systems, many impediments were yet found, and efforts had to be made to ensure a bright future for this business.

The demonetization of currency resulted in a massive increase in digital payments in India. Government initiatives such as Digital India, as well as increased mobile and internet usage, are paving the way for exponential development in the use of digital payment. More openness in transactions boosts the country's economy as a result of the shift to digital payments. Many innovations in the payment system, including as digital wallets, UPI, and BHIM applications, have occurred in recent days to facilitate the transition to digital payments. Dr.M.Kavitha and Dr.K. Sampath Kumar [8] discussed about the services customers favour from a payment bank. It also shows how simplicity and easiness are assisting payment institutions in growing their customer base. The impact of reference groups on a customer's decision to pick a bank is also investigated in the paper. Payment gateways have emerged as the most important driver of cashless and electronic payment adoption. The rapid proliferation of payment gateways in India reflects the rise of smart phones and 3G and 4G internet connections. The current research looked at customer preferences for payment gateways in terms of charges and risks, as well as the impact of demographic characteristics on payment gateway usage.

Encryption algorithms are the foundation of any secure communication between two parties. In light of this, Neelansh Prasad et al. [9] present a secure payment system that employs an encryption algorithm that they developed and integrated into the SET protocol's rules in the paper. Security is the top priority, as it should be in any payment system, and they've put a lot of effort into encrypting user information and preventing cracking. We achieved this by increasing the length of cypher text in comparison to any traditional encryption algorithm used in payment systems, while maintaining acceptable encryption and decryption times and throughput. The encryption algorithm used is based on Jumbling Salting. The initial version of the algorithm was modified, and the resultant was used.

The main goal of the paper written by Mostafa A. Ali et al. [10] is to look into the increased awareness of various electronic payment system-related concepts in terms of their benefits, drawbacks, and security concerns. Payment processing system providers employ the software as a service (SaaS) model, which allows them to create a single payment channel for a variety of payment methods for their customers. When users go online to make a payment, they frequently give away personal information such as their names, credit card numbers, and so on. A system that facilitates electronic money exchange is referred to as an online payment system. The Internet, computer networks, and other digital stored value systems are commonly used in this type of payment. Collecting any type of payment over the internet implies that the user has agreed to make a payment online and has shared some personal information with the service provider. This paper conducts a comprehensive examination of all aspects of online/electronic payment, with a focus on the analysis of numerous electronic payment studies. The most recent studies have been reviewed in order to gain a better understanding of electronic payment systems.

Maintaining Confidentiality and Privacy of data transported across the network is still a concern due to the vast volume of information available on the internet. Many people are unsure about where they should disclose their information. Many intruders hack and misuse personal and private information due to a lack of awareness. Sangeetha. J Pon et al. [11] developed a method that analyses all of the sites in the network and authorizes only those that are genuine. The technology use machine learning algorithms to assess websites and inform visitors about the site's legitimacy. As one of the most important aspects of the internet, supplying payment information in the payment gateway is also a challenging task. This system was created to give permission for e-commerce transactions. It ensures the integrity of the site while also detecting fraud in the payment gateway.

Due to the COVID-19 virus's high contagiousness, the Indian government has had to impose a number of limitations in order to contain the spread. The aviation, travel, and hospitality industries have borne the brunt of the economic implications of the limitations. Nonetheless, many other small, medium, and big businesses are feeling the pinch. With the lockdown permitting just the most vital industries to continue operating, disposable income expenditure is projected to plummet. Cash withdrawals from ATMs are a key indicator of overall retail economic activity. The authors Ashish Das et al. [12] illustrate how it affects Debit/Credit cards, UPI, IMPS, NEFT, and RTGS, as well as other digital payment channels. The authors showed how COVID-19, as well as the ensuing nation-wide lockdown and sluggish unlocking, impacted financial transactions in the country between April-May-June 2020. The substantial fall in retail payment operations in the country reflects the economy's complete slowdown. The authors examine the economic effects of COVID-induced lockdown and subsequent relaxations using transaction data from Q4 of FY20 and Q1 of FY21. Despite the fact that the economy is expected to suffer in FY21, some signs of a cautious and measured expansion of economic activity are seen, with payment transactions beginning to pick up in June 2020. As more individuals learn to utilize this mobile app-based, easy-to-use, digital way of payment, COVID's beneficial influence may be observed in rising levels of BHIM-UPI usage.

With blockchain, each record is connected through cryptography, allowing for an ever-growing list of records. Every block in the chain comprises a timestamp, transaction information, and a cryptographic hash of the preceding block. This is a safe method that will eventually take the place of the present online payment system. A modern internet payment gateway is vulnerable to hackers, who can meddle with the network and cause money loss. Not only that, but the transaction must pass through various payment systems, which takes time and increases the likelihood of the transaction failing. So, Karthikeya Thanapalet al. proposed a [13] system that would make use of blockchain, which allows online transactions to be sent directly from one party to another without going through a financial institution and in a secure manner. This system allows two parties to conduct online transactions using cryptographic proof without relying on or trusting a third party. The authors used a proof of work algorithm to record transactions, making it computationally impractical for an attacker to change them. Digital signatures are one component of a solution for ensuring the security and integrity of data stored on a blockchain.

Aditya Patel et al.[14] proposed a system in this paper that redesigns the method of transaction providing more ease of operation. The traditional method of conducting any transaction is to access a Merchant order page, choose the suitable item to purchase, and input an OTP at the Bank gateway page. In this article, the suggested system has created a concept to address the problem of an OTP being compromised by the user. Five elements are employed in the implementation of this suggested system. Face recognition, location history, card info, Transaction history, and OTP are all employed in this suggested system. As a result, the suggested approach makes the transactionsafer by incorporating these five elements. The authors have developed a website to demonstrate the system. The technologies used to publish their idea are HTML, CSS, JavaScript, Java EE, Servlets, DBMS technologies. For the registration purpose a database have been maintained in which the information of User email ID & password stored by database. The five-factor authentication feature comprises verification questions that the system will ask the user to confirm their identity. The time of the proposed transaction and its prior transaction time history are measured by time factors. The system will track the times when the most transactions occur and produce a single machine learning model based on the time parameter. Facial verification is included in facial recognition. Card information covers the user's debit or credit card number, expiration date, CVV, and other details. The password factor refers to the password that the user must input on the login page. The location factor contains a list of the places where the user has completed transactions. After each transaction, the system will update each of the factor information. If the system fails to recognise or validate the user's identity at any point, the transaction is terminated. & the user is unable to purchase further things.

Kavitha Esther Rajakumari et al. [15]proposed a secure method for bank transactions during online shopping using graphical passwords, which involves image processing. The project's goal is to help users choose and create a stronger password that cannot be readily hacked. This paper also discusses clustering and recommendation of itemspurchased by users during online shopping. Item-based recommendation is intended to avoid recommending unwanted things that are irrelevant to the user's buying [Noise suggestion]. Multilevel clustering is used to cluster and then group all of the elements.This initiative aids in the prevention of phishing attacks. In this sort of cyber-attack, the attacker utilises phishing e-mails to transmit various sorts of links or

attachments that may be compromised, including credential data such as login data or account information of the victim. This approach was developed to replace textual passwords, pins, and other simple password techniques that were difficult to remember and vulnerable to external assault. When a customer forgets their password, they must generate a new one that is difficult to remember as well as easy to steal. A graphical password is simpler to remember than a text password, and users may create their own passwords by combining pictures.As a result, several academics have recommended employing graphical passwords rather than text-based passwords. To validate the procedure, the user will choose a certain area of the screen. Based on double hashing, the project offers a system with pixel correlation for user verification.

Conclusion

The rapid growth of electronic payments has made drastic changes in the Indian market ecosystem. This paper examines how online payment methods are becoming more widely utilized for daily online and on-site transactions. The advantages and disadvantages associated with e-payments with their process have been described in this paper. Finally, differentiation has been made on the various payment gateways and e-wallets present in the country serving the user to choose the best payment option available for their business. Furthermore, it has been concluded that by this rate, digital payments would account for 3/4th of total payments volume in the country, while cash and checks would account for a quarte

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