AI-Powered Digital Payments: Evolution, Securing Transactions & Preventing Fraud

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Abstract: The rapid expansion of digital payment systems has transformed financial transactions, increasing convenience, speed, and accessibility. However, the increased reliance on digital payments has raised worries about security, fraud, data privacy, and regulatory compliance. Traditional security methods frequently fail to identify complex cyber threats, needing more modern technology solutions. Artificial intelligence (AI) has emerged as a game changer in digital payments, using machine learning (ML), predictive analytics, robotic automation, and biometric authentication to increase security, speed payment processes, and enhance user experience. AI plays an important role in fraud detection by analyzing massive volumes of transaction data in real time to discover anomalies and prevent unauthorized activity. Furthermore, AI-powered risk assessment algorithms improve credit scoring and financial decision-making, resulting in greater financial inclusion. AI-powered chatbots, speech recognition technologies, and tailored financial suggestions improve client engagement while making transactions easier and more efficient. With the increasing complexity of digital transactions, the demand for AI-powered security solutions has never been greater. AI assists financial firms with complying with regulatory norms, reducing human intervention, and ensuring speedier, error-free transactions. Despite its benefits, issues such as data privacy, AI bias, and cybersecurity dangers persist. This article investigates the history of digital payments in India, the use of AI to secure transactions, its role in fraud detection, and the future trends influencing AI-powered digital payment ecosystems.

Keywords: Artificial Intelligence (AI), Digital Payment, Fraud Prevention, Digitalization

1. INTRODUCTION

Artificial intelligence (AI) is transforming industries, including digital payments. AI technology has the potential to transform digital payment systems by improving speed, security, and consumer experience. AI is transforming the digital payment process using machine learning, robotic automation, predictive analytics, and chatbots. The rapid evolution of digital payment systems has significantly transformed the financial landscape, enabling faster, more efficient, and seamless transactions. As global economies move towards a cashless society, the reliance on digital payment platforms has surged. According to the Reserve Bank of India (2020), digital payment transactions in India witnessed a 237% increase in 2020 due to the growing adoption of mobile wallets, UPI, and contactless payments. However, with this transition comes a new set of challenges, including cybersecurity risks, fraudulent transactions, and regulatory compliance issues (Singh, 2020).

To combat these challenges, Artificial Intelligence (AI) has emerged as a key technological enabler in the digital payment ecosystem. AI-driven solutions utilize machine learning (ML), robotic process automation, natural language processing (NLP), and biometric authentication to enhance payment security, detect fraud, and optimize customer experiences (Kumar, 2023). AI has proven particularly effective in fraud detection, where sophisticated algorithms analyze transactional patterns, detect anomalies, and flag suspicious activities in real time (Patra et al., 2022).

1.1 Need for AI in Digital Payments

The shift towards digital payments has significantly increased fraud risks, including identity theft, phishing attacks, and payment card fraud. According to a report by Tao et al. (2019), financial fraud cases linked to online transactions have increased by 150% in the past decade. Traditional rule-based fraud detection mechanisms are often insufficient in addressing the complexity of modern cyber threats, necessitating the adoption of AI-powered security measures (Awotunde et al., 2021).

Additionally, AI enhances transaction speed and accuracy by automating payment processing, reducing human intervention, and enabling real-time decision-making (Rawat et al., 2021). The use of AI in credit scoring and risk analysis has also made digital payments more accessible, particularly for individuals with limited credit history, as AI-based credit models consider alternative data sources such as spending behavior and transaction history (Thisarani & Fernando, 2021).

1.2 Objectives

1. To analyze the historical evolution and growth of digital payments in India.

2. To evaluate the role of Artificial Intelligence (AI) in enhancing the security of digital payment systems.

3. To examine AI-driven fraud detection mechanisms in digital payments and their effectiveness in preventing financial fraud.

1.3 AI's Role in the Digital Payment Ecosystem

AI is redefining digital payment security through various innovations:

- 1. Fraud Prevention: AI-driven anomaly detection systems continuously monitor transactions, identifying and blocking fraudulent activities (Khan et al., 2022).
- 2. Biometric Authentication: AI-powered facial recognition, fingerprint scanning, and voice authentication ensure secure and seamless payment experiences (Deepa et al., 2022).
- Automated Risk Assessment: AI evaluates user profiles to detect potential fraud risks before processing payments (Panguluri & Jasti, 2024).
- 4. Predictive Analytics: AI analyzes past transactions to predict future spending patterns and improve financial decision-making (Gupta, 2024).

As digital transactions continue to grow exponentially, AI will remain a critical component in ensuring secure, efficient, and fraud-free financial ecosystems. This paper explores the evolution of digital payments in India, the integration of AI in securing transactions, AI's role in fraud detection, and the future of AI-driven payment technologies.

1.4 Research Methodology

This review study is based on secondary data gathered from government and non-government sources, including research papers, industry reports, and newspaper articles. Peer-reviewed papers and conference proceedings were examined to determine AI's contribution in digital payment security and fraud detection. A qualitative approach was taken to uncover major trends, technological breakthroughs, and challenges in AI-powered digital payments. The study examines existing literature to get insight into AI's impact on transaction security, efficiency, and fraud prevention.

2. Evolution of Digital payments in India

India's payment systems have changed significantly throughout time. The country has transitioned from historical barter systems and coin-based transactions to digital payment networks, which today constitute the foundation of financial activities. In India, payment methods and techniques have also been around for a while. Coins with punch markings were used as payment devices in the past. These coins were made of copper and silver, and interregional money transfers were made possible by the credit system, which included bills of exchange. In ancient world coins were issued by Chinese, Indians, and Middle Eastern Lydians. Ancient India's Mahajan pads or Republic Kingdom produced the first coins in the sixth century BC. (Goyal, 2017). Have you ever considered or talked with people you know if you would cease using cash today? It used to be a hypothetical issue because it was all about keeping cash in your wallet or writing checks, but things have changed tremendously in recent years. India has a wonderful success story to tell about how a cashdriven country became the largest gainer in the digital payment business Achutamba & Hymavathi (2022). The most major cause for this is the rise of the UPI (Unified Payment Interface), which is a rapid and simple way to transfer and send funds. Demonetization, government actions, and COVID-19 all served as catalysts. The major methods of electronic payment that played an important role in this financial revolution are UPI (United Payment Interface), Banking Cards, USSD (Unstructured Supplementary Service Data), AEPS (Aadhaarenabled Payment System), Mobile Wallets, Point of Sale Machines (POS), Mobile Banking, Bank Prepaid Cards, Internet Banking, and NEFT (National Electronic funds transfer). Every day, more than a billion digital transactions occur, and the government intends to take it a step further by guaranteeing that India's economy grows to \$5 trillion by 2025. Gupta (2024).

1. UPI (Unified Payment Interface)

The Unified Payments Interface (UPI) is a real-time payment system designed by the National Payments

Corporation of India (NPCI) and launched in Mumbai on April 11, 2019 by Dr. Raghuram G. Rajan, Governor, RBI. UPI is a simple way to send and receive money in India using a smartphone. You link your bank account to UPI apps, and a unique UPI ID is generated. You can link several bank accounts and send money without knowing the receiver's bank credentials; all you need is their virtual payment address (VPA). Fintech businesses such as Paytm, Phonepe, and GooglePav have developed a highly secure and user-friendly infrastructure with no transaction fees for sending and receiving money via UPI According to NPCI data, only 26 banks were operational in October 2016, with 46.57 crore of transactions completed, but by October 2023, there were 505 active banks and 17,15,768.34 crore of transactions completed, representing nearly a billion UPI transactions every day. Gupta (2024).

2. Demonetization

Demonetization On November 8, 2016, the government demonetized the existing 500- and 1000rupee notes and replaced them with the freshly designed 500- and 2000-rupee notes, surprising everyone. The major goal was to reduce the circulation of black money while encouraging digital and cashless transactions. There was a lot of cash in the market, and everyone was lined up to swap notes Gupta & kumar (2017). People were left with little choice but to use digital payment, resulting in a growth in the usage of online banking services, checks, e-wallets, and banking cards for all fundamental transactions. According to NPCI data, UPI transactions increased from 1,03,060 in October 2016 to 91,67,277 in May 2017, representing an astounding 89-fold growth. Value-wise, UPI increased by Rs. 0.49 billion to 27.65 billion, more than 56 times the growth rate during the same period. Digital transaction volumes increased by 43% between November and December of 2016 Gupta (2024).

3. Government Initiatives

Government Initiatives Since 2016, the government has actively supported online payments, with the main goal of creating a "faceless, paperless, cashless" digital Indian economy. They began with two initiatives: the Pradhan Mantri Jan Dhan Yojana, a final inclusion initiative begun in 2014, and the Digital India program, which aims to empower people digitally in 2015. The Pradhan Mantri Jan Dhan Yojana contributed significantly to India's achievement of 457 million new bank accounts. Citizens were encouraged to link their unique biometric Aadhaar identification and mobile numbers with their bank accounts, enabling citizens across the country to digitally access their accounts and participate in the digital economy. Creehan (2017).

4. Covid-19 pandemic

The COVID-19 was the most revolting experience in human history. "The COVID-19 was the most revolting experience in human history. We had no idea what was going on, but it did help accelerate the digitalization of payments. According to NCPI data, digital payments fell sharply as a result of the lockdown and shutdown. However, individuals began to see the advantages of contactless and cashless payments" (Singh, 2020, p. 46). They were safer and more convenient, which encouraged customers to utilize digital payments. According to RBI annual data, UPI transaction volume decreased continually in 2020 till April, decreasing 19.8% from last year. However, the effect of social separation improved significantly as the lockdown was gradually eased, resulting in a record 1.34 billion transactions in June 2020. Even Rupay card transactions in e-commerce increased to 237% in April from 76.8% in February 2020. All digital payment mechanisms (credit card, debit card, UPI, POS, PPIs, etc.) experienced comparable growth rates.

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3. LITERATURE REVIEW

Kumar, (2023) suggests AI systems improve fraud detection by monitoring suspicious activity in real time. Big Data analytics improves the accuracy of risk assessments and predictive models by providing insights into transaction patterns. Advanced cybersecurity methods, such as encryption and multifactor authentication, provide extra protection against changing threats. Integrating these technologies can help financial institutions prevent fraud, protect user data, and boost confidence in digital payment systems.

Patra et al. (2022) suggest by applying AI, Big Data, and biometric authentication to improve security aspects in digital payment systems. The authors explored how these technologies can improve fraud prevention, transaction security, and financial service experience. This integration may enhance the security of online transactions and increase consumer trust in digital payments through a multi-layered approach.

According to Tao et al. (2019), protecting large-scale datasets is a tough task for companies, particularly from an economic standpoint. This study identifies dynamic threats to Big Data security, including cyberattacks and data breaches. It emphasizes the importance of implementing complete privacy procedures. To protect sensitive financial data, the authors advocate both encryption and real-time security monitoring.

According to Awotunde et al. (2021), Big Data and Fintech are transforming financial services by incorporating AI and blockchain technology to enhance transaction security. Big Data analytics and AI can forecast market trends, fraud, and personalize client experiences. The research highlights the growing importance of these technologies in modern financial systems, which can reduce risks and improve transparency in transactions.

Rawat et al. (2021) discuss the issues of Big Data for cybersecurity and the necessity for a more advanced security approach in today's data-driven decisionmaking environment. This study identifies possible risks associated with growing Big Data quantities and proposes solutions such as machine learning-based threat detection, safe data storage, and automated anomaly detection. The authors advocate for proactive cybersecurity to secure Big Data applications in various industries, including financial operations.

Thisarani and Fernando (2021) explored the use of AI in banking to improve decision-making, risk management, and customer experience. AI can automate functions like fraud detection, credit ratings, and transaction monitoring, leading to faster and more secure financial operations. The article highlights the importance of AI in improving financial security and tailored banking services.

Khan et al. (2022) conducted a thorough literature study on AI applications in GCC financial sectors. The assessment focused on how AI technologies enhance services such as fraud detection, transactions monitoring and customer service.

AI benefits the sector by boosting productivity, security, and regulatory compliance. The authors argue that AI is the primary driver of innovation in the GCC financial sector and will shape the future of digital payments.

N. Deepa et al (2022) This study reviews the integration of blockchain and Big Data, highlighting opportunities, problems, and future prospects in the field. This article discusses how blockchain technology enhances the security, transparency, and scalability of Big Data applications. Blockchain technology offers a possible way to address data integrity, trust, and privacy issues in Big Data systems. The study explores how these technologies might be used to decentralize data storage, improve traceability, and assure secure data sharing, which is crucial for sectors dealing with sensitive information. The report highlights how blockchain could transform financial transactions, healthcare, and supply chain management. The report highlights research gaps and suggests future approaches for blockchain-based Big Data solutions.

Digital payments have greatly benefited both consumers and businesses. The digital payment ecosystem is seeing growth, but it also poses a threat of fraudulent activity. Illegitimate and fraudulent transactions not only cause financial loss, but also harm faith in digital payments. Businesses now use sophisticated algorithms to detect fraudulent transactions, functioning as digital detectives in the digital payment environment.

4. APPLICATIONS OF ARTIFICIAL INTELLIGENCE IN DIGITAL PAYMENTS

AI-powered payment systems use machine learning (ML), natural language processing (NLP), robotic automation, and biometric authentication to enhance financial transactions (Kumar, 2023). These tools analyze massive amounts of data, recognize spending patterns, predict fraud, and enable real-time decision-making.

1.Detecting and preventing fraud.

AI-based fraud detection systems examine transaction patterns and detect suspicious activities in real time (Patra et al., 2022). AI models can detect anomalies in spending habits, unexpected geographic locations, or inconsistent login patterns, stopping fraudulent transactions before they happen (Tao et al., 2019). AI is always learning from past fraud cases, adjusting its algorithms to detect new forms of cyber risks, reducing false positives, and enhancing security (Awotunde et al., 2021).

2. Credit Scoring and Risk Assessment

Traditional credit scoring models rely on a few parameters, such as income and credit history, but AIpowered credit scoring takes into account a wide range of factors, including digital payment behavior and social data (Thisarani & Fernando, 2021). Artificial intelligence allows financial firms to more accurately analyze risk profiles, anticipate loan default probability, and optimize interest rate decisions (Khan et al., 2022).

3. Natural Language Processing (NLP) for Digital Payments

AI-powered chatbots and virtual assistants improve customer service by efficiently addressing transaction inquiries and payment concerns (Deepa et al., 2022). AI-powered voice recognition technology enables hands-free transactions, making digital payments more accessible to those with disabilities (Singh, 2020). Furthermore, AI-powered NLP technologies assess client interactions to improve customer service and optimize financial product suggestions (Kumar, 2023).

4. Personalization and Customer Experience.

AI improves the user experience by studying purchase histories and behavioral patterns to offer personalized recommendations and dynamic payment choices (Gupta, 2024). AI-powered predictive analytics can recommend loyalty programs, subscription plans, and financial goods based on customer transaction history (Khan et al., 2022).

5.Real-time Payment Processing.

AI makes payment processing faster and safer by instantly evaluating transactions and reporting potential fraud before they are processed (Rawat et al., 2021). AI-powered automation improves payment settlements by minimizing human intervention and operating costs for banks and enterprises (Awotunde et al., 2021).

6.Facial recognition and biometric authentication.

AI-powered biometric authentication technologies, such as facial recognition, fingerprint scanning, and voice verification, enable secure access to digital wallets and banking apps (Deepa et al., 2022). These AI-powered security solutions reduce the dangers associated with passwords and PINs, resulting in a safer authentication process (Tao et al., 2019).

7. Predictive Analytics for Financial Forecasting.

Predictive analytics enabled by AI assists financial institutions in anticipating market trends, currency exchange changes, and investment opportunities (Singh 2020). AI-powered algorithms use historical transaction data to estimate consumer spending behaviors, allowing businesses to personalize their financial services (Gupta, 2024).

3. Role of AI in Digital Payments

AI has transformed digital payment systems by offering enhanced security, fraud detection, real-time processing, and personalized financial services

3.1 AI Technologies Used in Digital Payments

In digital payments, AI-driven machine learning (ML) models evaluate transaction patterns in realtime to detect and prevent fraud. AI continuously learns from new threats, resulting in adaptive security.

Sr No.	AI Application	Description					
1	Credit Scoring & Risk Analysis	AI assesses various data points (e.g., spending behavior, social					
		interactions) for better credit risk evaluation.					
2	Natural Language Processing	AI chatbots assist users with transactions, answer queries, and					
	(NLP)	provide financial advice					
3	Personalization	AI analyzes user behavior to recommend offers and optimize					
		financial planning.					
4	Real-Time Payment Processing	AI enhances transaction speed, efficiency, and reduces errors.					

5	Biometric Authentication	AI	enables	secure	authentication	using	fingerprints,	facial	
		recognition, and other biometrics.							

4. Types of Digital Payment Fraud.

AI plays an important role in reducing fraud risks in digital payments by detecting suspicious activity and avoiding financial crime.

1. Payment Card Fraud: Digital fraudsters utilize stolen card information to make unlawful purchases, which is commonly obtained by skimming or phishing (Taghiyev et al., 2021).

2. Account Takeover Fraud: Hackers obtain access to consumers' financial accounts through weak passwords and security flaws (Kawase et al., 2019).

3. Identity Theft: Fraudsters utilize stolen personal information to make financial gains, such as asking for loans or carrying out illicit activities (Vieraitis et al., 2015).

4. Phishing and spoofing: Attackers impersonate reputable organizations to trick consumers into disclosing sensitive financial information (Pallavi et al., 2024).

Artificial intelligence has become a crucial component of application development and industry solutions, beyond its promise as a mainstream technology. Artificial Intelligence-powered applications will become essential tools for combating fraudulent activity in the digital payments arena, given the rapid transformation in recent years Panguluri & Jasti (2024).

5. BENEFITS OF AI IN DIGITAL PAYMENTS

1. Enhanced Security & Fraud Prevention

AI-powered security measures reduce fraud risks by analyzing large datasets in real-time. Machine learning algorithms detect fraudulent patterns and prevent unauthorized transactions. Additionally, AIdriven biometric authentication, such as facial recognition and fingerprint scanning, improves digital transaction security (Kumar, 2023).

2. Improved Operational Efficiency

AI automates payment processing, reducing manual intervention. Financial institutions deploy AIpowered chatbots and virtual assistants to streamline customer service, resulting in faster resolution times and greater efficiency (Thisarani & Fernando, 2021).

3. Improved User Experience

AI improves the user experience by making tailored payment recommendations and performing

predictive analytics. AI-powered virtual assistants, like those used by PayPal and Google Pay, help with financial management by analyzing transaction history and recommending personalized financial plans (Khan et al., 2022).

4. Regulatory Compliance

AI helps financial organizations comply with financial regulations like GDPR and RBI standards by automating transaction monitoring and risk assessment. AI-driven compliance systems detect money laundering patterns and generate real-time compliance reports, reducing regulatory penalties (Deepa et al., 2022).

6. CONCLUSION

The incorporation of artificial intelligence (AI) into digital payments has transformed the financial environment by improving security, fraud detection, real-time processing, and personalized user experiences. AI-powered technologies such as machine learning (ML), natural language processing (NLP), biometric authentication, and predictive analytics have considerably increased the efficiency and security of digital transactions (Kumar, 2023).

One of AI's most important contributions is fraud detection and prevention, in which AI-powered systems examine massive transaction data to discover anomalies and prevent fraudulent activity (Patra et al., 2022). By examining alternative data sources such as transaction history and spending behavior, AI improves credit risk assessment and makes financial services more accessible to persons with nontraditional credit histories (Thisarani & Fernando, 2021).

Furthermore, artificial intelligence has streamlined digital payment processing, minimized human participation while enhanced transaction speed and accuracy. AI-powered chatbots, voice recognition systems, and real-time payment automation have enhanced the user experience, making financial services more efficient and accessible (Deepa et al., 2022). AI-driven predictive analytics is especially important in financial forecasting, assisting institutions in anticipating market trends and consumer behavior (Gupta, 2024).

However, data privacy concerns, AI bias, cybersecurity threats, and regulatory compliance issues must be solved in order to fully realize AI's promise in digital payments (Tao et al., 2019). Moving forward, advances in AI-driven security solutions, blockchain integration, and quantum computing will reshape digital payment ecosystems, making financial transactions safer and more efficient (Khan et al., 2022).

To summarize, AI is revolutionizing not only digital payments, but also the future of financial security and innovation. To fully realize AI's promise, continual developments, regulatory frameworks, and ethical AI practices must be prioritized in order to build a sustainable and inclusive digital payment environment.

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