

ENHANCING REAL-TIME PAYMENT SYSTEMS: AI SOLUTIONS FOR SECURITY, EFFICIENCY, AND USER EXPERIENCE

Dr. Srinidhi Vasan

Institutional Affiliation: Hult International Business School

Email Address: srinidhi.vasan@outlook.com

Abstract: *This study investigates the challenges users face with real-time payment systems and how AI in fintech can address these issues. Surveys in Boston and Bengaluru identified common problems like security concerns, slow customer support, and difficulties in tracking transactions. Key findings reveal that scams greatly undermine user trust, long wait times for support are frustrating, and tracking issues cause confusion. AI can offer effective solutions by enhancing security with advanced fraud detection and antivirus integration, improving customer support with AI chatbots and predictive systems, and increasing transparency with intuitive dashboards and real-time notifications. AI-driven biometric verification can also resolve identification issues. By leveraging AI, the finance industry can enhance the reliability and user-friendliness of payment systems, encouraging wider adoption of digital payments. This study provides insights into user experiences and lays the groundwork for future advancements in real-time payment systems.*

Keywords: *Real-Time Payment Systems, Fintech, Artificial Intelligence, User Experience, Digital Payments*

Introduction

Real-time payment systems have transformed the financial sector by enabling instant, secure transactions that provide immediate access to funds. These systems enhance transaction efficiency and convenience, driven by increasing demand for faster payment solutions in both personal and business settings. As digital economies grow, real-time payment systems are essential for maintaining smooth cash flows and improving financial inclusion (Bank for International Settlements, 2020; World Bank, 2019).

In India, the Unified Payments Interface (UPI), introduced by the National Payments Corporation of India (NPCI) in 2016, has significantly boosted real-time payments. UPI allows instant money transfers via mobile devices, resulting in billions of transactions each month (NPCI, 2023). Government initiatives promoting digital payments have accelerated the shift towards a cashless economy, enhancing financial inclusion and sparking innovation in the fintech sector (RBI, 2022).

In the United States, the upcoming FedNow Service from the Federal Reserve, set to launch in 2023, will establish a nationwide framework for instant payments. This service will support real-time gross

settlement and complement the existing Real-Time Payments (RTP) network operated by The Clearing House (Federal Reserve, 2021). Although the U.S. has been slower to adopt real-time payments due to its complex financial system, the growing demand for faster payment options is expected to significantly enhance transaction efficiency for both consumers and businesses (Clearing House, 2021).

Need for study

The aim of this study was to explore and validate the real challenges that users encounter with real-time payment systems, focusing on how AI in fintech can address these issues. We conducted surveys in Boston and Bengaluru to gather insights into common problems like security concerns, slow customer support, and difficulties in tracking transactions. By understanding these issues from the perspectives of users in different regions, we hope to guide future enhancements and innovations that will make these payment systems more secure, efficient, and user-friendly through the application of AI.

Methodology

In this study, we combined both primary and secondary data to provide a thorough analysis. Secondary data was sourced from various online platforms, including articles, journals, and official government websites. For primary data collection, we conducted qualitative research through a survey. This survey was modeled after the "Questionnaire For Adoption of Mobile Wallet" by Aditya Shukla.

To better understand the challenges of real-time payment systems, we designed a new questionnaire. This survey was administered to 40 anonymous participants, equally split between Boston and Bengaluru. It featured 14 multiple-choice questions, designed to facilitate detailed analysis and extract meaningful insights from the responses (Shukla, A., n.d.).

Techniques of Data Analysis

In this paper, we use qualitative research methods to gather and analyze primary data, including content analysis, conceptual analysis, and sentiment analysis. Content analysis helps us systematically categorize textual information to identify patterns, themes, and meanings (Vaismoradi et al., 2013). Conceptual analysis examines how often certain concepts appear in the data and explores their significance and relationships (Busch et al., 2012). Sentiment analysis assesses the emotions and attitudes expressed in the data, providing insights into respondents' feelings about the usage and challenges of real-time payment systems (Pang & Lee, 2008). We analyze each challenge users face, grouped by location, to understand the underlying reasons and offer solutions in the following sections.

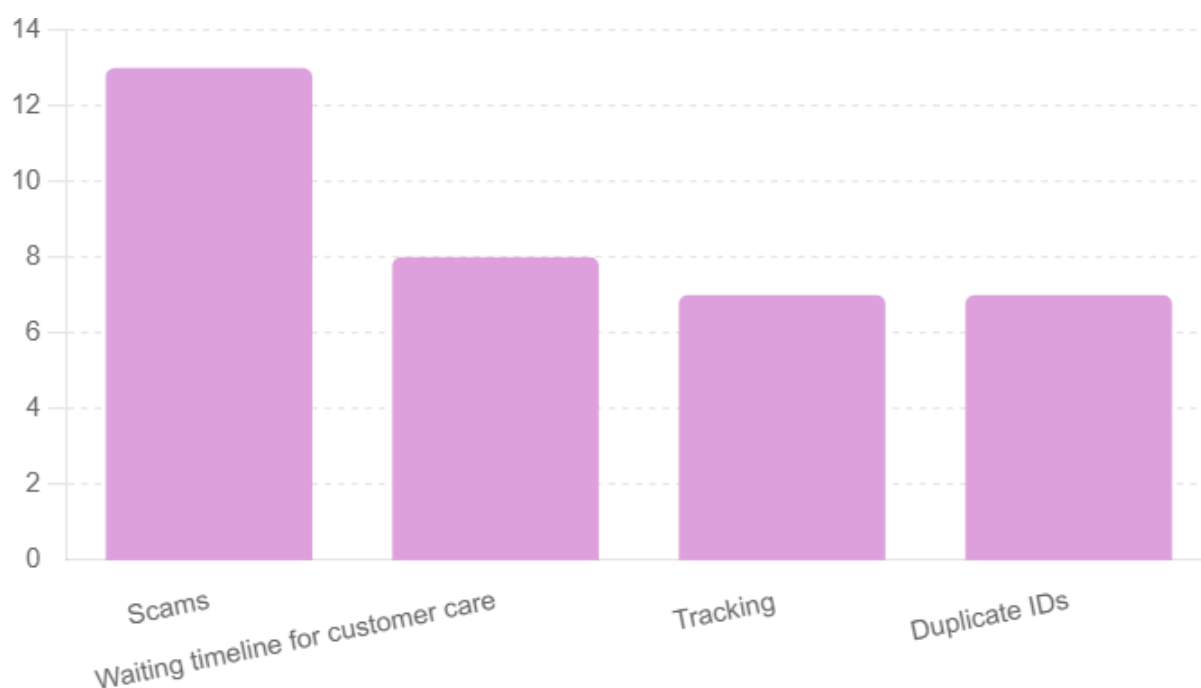
Findings

A detailed survey examined the complex relationships among various factors like location, age, industry, gender, mobile payment usage, application preferences, ratings, usage frequency, and the challenges and solutions associated with real-time payment systems. The goal was to uncover patterns and correlations that affect user experiences and sentiments.

The graphical representation of these patterns from the survey and its description are:

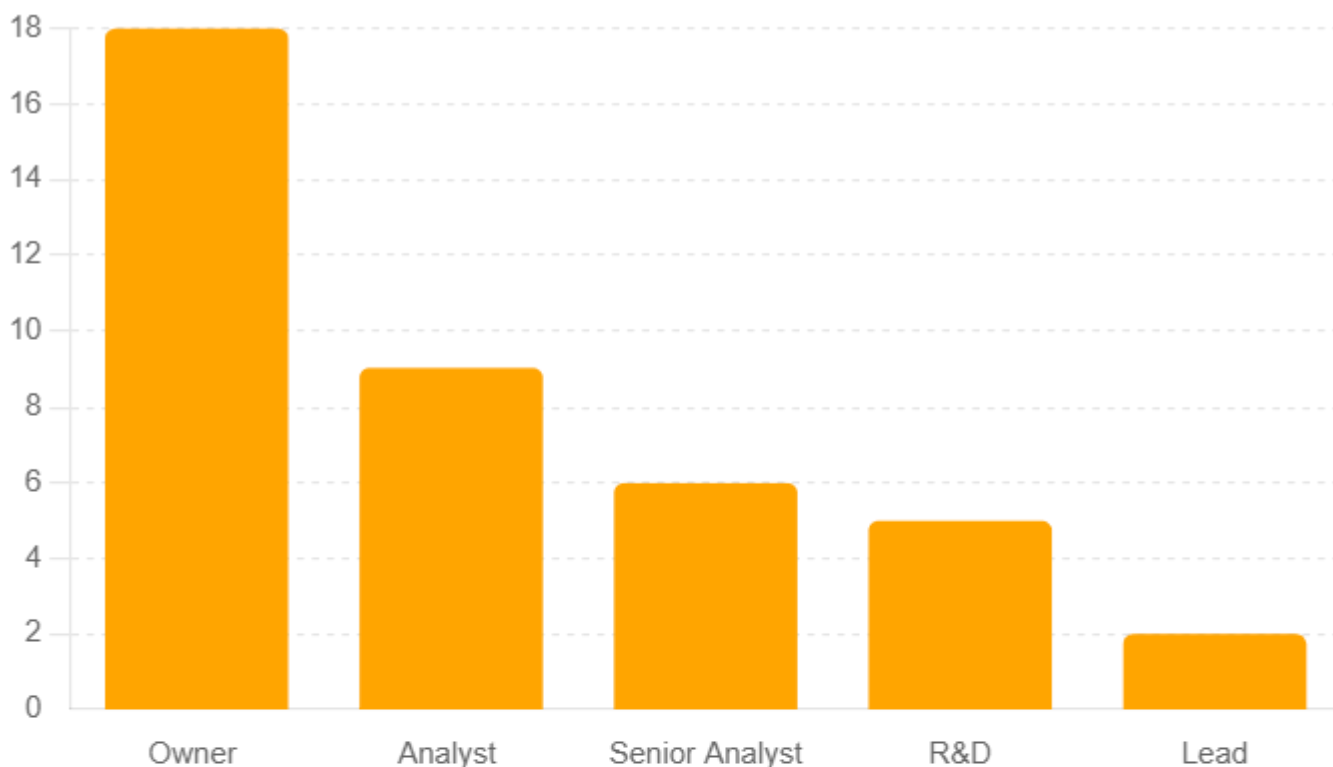
Challenges Encountered:

Users identified scams as the primary issue, causing significant frustration due to fraudulent activities. Long wait times for customer support were also a common complaint, particularly among those needing prompt assistance. Many users struggled with tracking their transactions, leading to confusion and trust issues. Additionally, some faced problems with duplicate IDs, further complicating their payment experiences.



User Roles and Industries:

The majority of respondents were business owners and analysts, indicating that decision-makers and data professionals are heavily involved with these systems. There was also representation from research and development and lead positions, highlighting a diverse professional audience providing valuable insights.



Preferred Solutions:

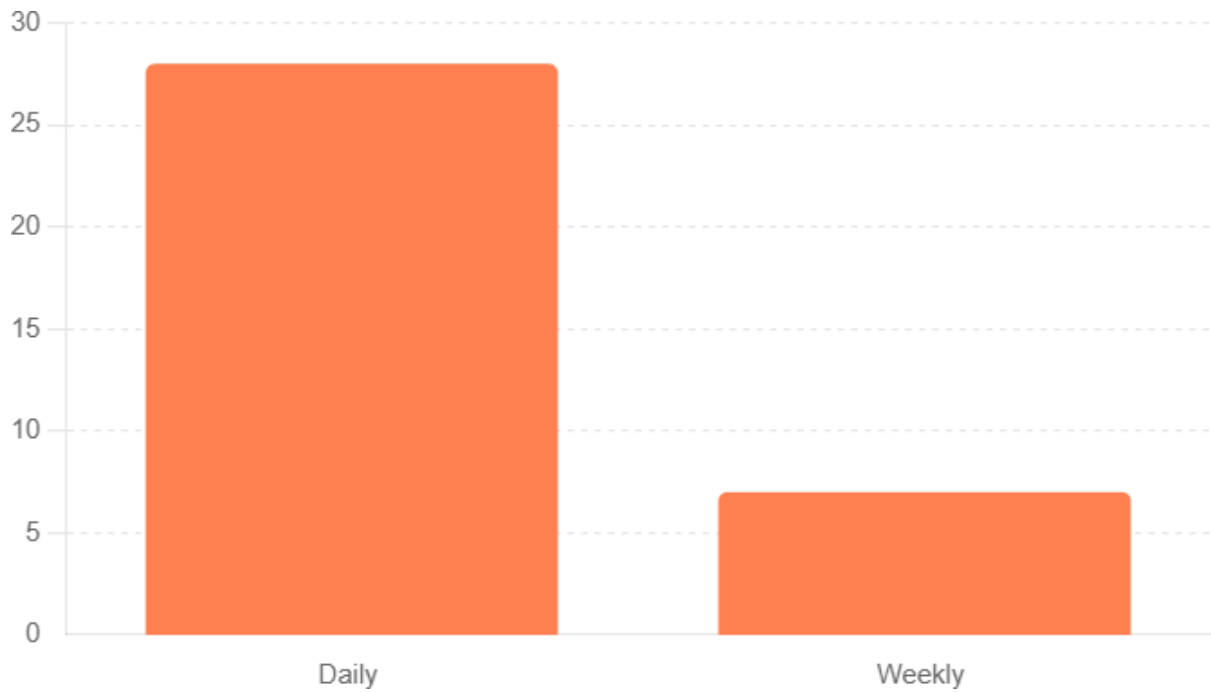
Participants expressed clear expectations for improving real-time payment systems. The most sought-after solution was integrating antivirus software into mobile apps to enhance security. Many users also favored the use of bots in customer care to reduce wait times and increase efficiency. A user-friendly

dashboard was a high priority, aiming to make the interface more intuitive and accessible. Additionally, integrating unique identification numbers was suggested to strengthen security measures.



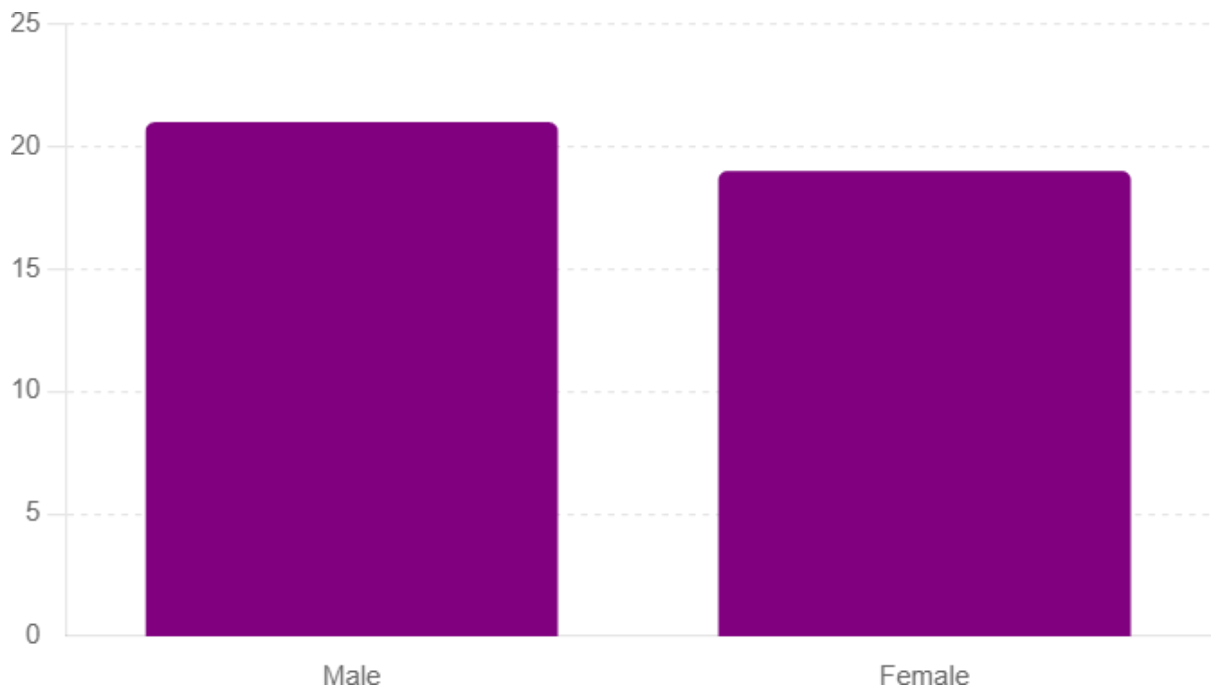
Usage Frequency:

The survey revealed that a significant majority of users engaged with mobile payment systems daily, indicating their essential role in everyday transactions. A smaller portion used these systems weekly, possibly due to different needs or transaction volumes.



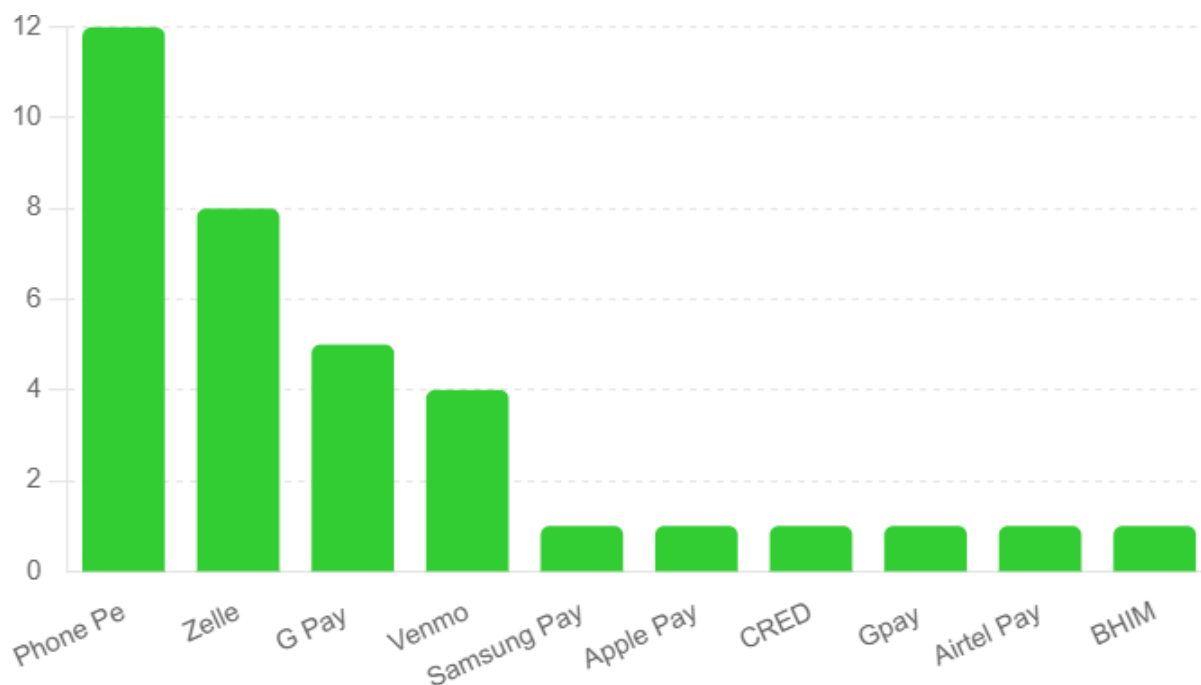
Demographic Insights:

The gender distribution among respondents was fairly balanced, showing widespread acceptance of mobile payments across genders. The age distribution peaked around 30 years old, indicating that young adults are the primary users. Both employed individuals and business owners actively used these systems, demonstrating their broad applicability in both personal and professional settings.



Application Preferences:

PhonePe was the most popular application, particularly in regions like Bengaluru, while Zelle and Venmo were preferred in Boston, illustrating regional differences in application choices. Google Pay (G Pay) and other apps like Samsung Pay, Apple Pay, and CRED also had a notable user base, though smaller in comparison.



Usage Patterns in Boston and Bengaluru

Boston vs. Bengaluru Application Preferences:

In Boston, Zelle and Venmo emerged as the top choices for mobile payment applications, reflecting a preference for secure, bank-linked services known for their seamless integration with traditional banking systems. Meanwhile, in Bengaluru, Paytm and Google Pay were more popular. These applications offer a variety of services beyond payments, such as bill payments and shopping, which cater to the diverse needs of Indian users.

Transaction Frequency:

Boston users reported a higher frequency of daily transactions, indicating that real-time payment systems are well-integrated into their everyday financial activities. This high usage could be attributed to the strong digital payment infrastructure and widespread acceptance of these systems in retail and peer-to-peer transactions. In contrast, Bengaluru users reported weekly transactions more frequently. This lower usage rate may be influenced by factors such as internet reliability, transaction costs, and the still prevalent cash-based economy in some areas.

Demographic Influences:

The survey highlighted that age and industry type significantly influence the adoption of real-time payment systems. Younger individuals and those working in tech-savvy industries showed a higher tendency to use these systems, suggesting a generational shift towards digital financial solutions in both locations.

Common Challenges and Potential Solutions

Tracking Transactions:

Both Boston and Bengaluru users expressed difficulties in tracking their transactions, leading to uncertainties and trust issues. This indicates a need for more transparent and user-friendly interfaces that provide real-time updates and detailed transaction histories.

Security Concerns:

Scams were a major concern in both cities, highlighting the necessity for better security measures. Users reported encountering fraudulent activities, suggesting that current security protocols may be inadequate.

Customer Support:

Long waiting times for customer support were a significant issue, especially in Bengaluru. This points to a gap in customer service infrastructure that needs to be addressed to improve user satisfaction and trust.

Proposed Solutions:

The solutions tried by users often fell short of addressing these challenges effectively. There is a clear demand for proactive solutions like user-friendly dashboards, antivirus integration, and the use of bots in customer care to enhance security and efficiency.

Sentiment Analysis: Positive and Negative Experiences

Positive Sentiments:

Users who rated their experiences highly appreciated the convenience and speed of transactions. In Boston, the interoperability of apps like Zelle and Venmo, which allowed seamless transactions across different banks, was particularly valued.

Negative Sentiments:

Negative feelings were prevalent among users who faced challenges such as scams and inefficient customer care, leading to frustration and distrust. In Bengaluru, long waiting times for customer support and technical glitches were significant concerns that adversely affected user satisfaction.

Correlations Between Variables and User Sentiments

Positive Correlations:

Frequent users who faced fewer issues tended to be more satisfied and gave higher ratings to their experiences. Additionally, users who adopted proactive security measures, such as using antivirus software or more secure payment applications, reported fewer negative sentiments.

Negative Correlations:

The occurrence of scams was strongly negatively correlated with user satisfaction. Users who encountered scams rated their experiences poorly and expressed significant frustration. Similarly, long waiting times for customer care were negatively correlated with user satisfaction, underscoring the need for more efficient support systems.

Conclusion

The survey results provide an in-depth look at how users experience and perceive real-time payment systems. It highlights several critical challenges and identifies areas where artificial intelligence (AI) can drive significant improvements, ensuring these systems are secure, efficient, and user-friendly.

Strengthening Security Measures

One of the major findings is that scams are a prevalent issue, greatly undermining user trust. This calls for advanced security measures to protect users from fraudulent activities. AI can be instrumental in this regard. By employing sophisticated AI-driven fraud detection systems, transactions can be monitored in real-time to spot suspicious activities and potential fraud. These systems can learn and adapt to new fraud patterns, offering a dynamic defense against scams. Furthermore, incorporating antivirus protection within mobile payment apps can safeguard users against malware and phishing attempts, thereby enhancing overall security and restoring user confidence.

Improving Customer Support

Long wait times for customer support emerged as a significant pain point, particularly in Bengaluru. AI can address this by deploying AI-powered chatbots that provide instant responses to user queries. These chatbots can handle routine questions, resolve common issues, and escalate more complex

problems to human agents when necessary. This approach ensures that users receive timely support, reducing frustration and improving satisfaction. Additionally, AI can power predictive support systems that analyze user behavior and transaction history to anticipate issues before they arise. Proactive support can help prevent problems, enhancing the user experience and reducing the burden on customer care teams.

Enhancing Transaction Transparency

Many users reported difficulties in tracking their transactions, leading to confusion and mistrust. AI can help by developing intuitive and transparent transaction tracking systems. By creating user-friendly dashboards that provide clear, detailed views of transaction histories, users can easily monitor their payments. AI can personalize these dashboards, tailoring them to individual user preferences and behaviors for an even better user experience. Implementing real-time notifications and alerts will keep users informed about their transaction statuses, reducing uncertainties and building trust.

Ensuring Secure Identification

Issues with duplicate IDs, though less common, still pose challenges. AI can enhance the security and reliability of identity verification processes. Biometric verification and AI-driven identity checks can ensure that each user is uniquely identified, preventing duplicate ID issues. These technologies can streamline the verification process, making it more secure and user-friendly.

Elevating User Experience

Beyond addressing specific challenges, AI offers vast potential to improve the overall user experience. AI can analyze user data to provide personalized financial insights and recommendations, helping users make informed decisions. Adaptive user interfaces that evolve based on user behavior can make the system more intuitive and enjoyable. For instance, frequently used features can be made more accessible, enhancing convenience and satisfaction.

The survey results illuminate the critical challenges and opportunities in real-time payment systems. Addressing issues such as security, customer support, transaction transparency, and secure identification are paramount. AI presents a powerful solution to these challenges, offering advanced fraud detection, efficient customer support, enhanced tracking, and robust identification systems. By leveraging AI, the finance industry can significantly improve user satisfaction and trust, fostering greater adoption of digital payment solutions. As the sector continues to innovate, AI will be essential in ensuring these systems are not only effective but also user-friendly and secure.

References

- Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13(3), 319-340. <https://doi.org/10.2307/249008>
- Pang, B., & Lee, L. (2008). Opinion mining and sentiment analysis. *Foundations and Trends in Information Retrieval*, 2(1-2), 1-135.
- Busch, C., De Maret, P. S., Flynn, T., Kellum, R., Le, S., Meyers, B., ... & Palmquist, M. (2012). Content analysis. Writing@CSU. Colorado State University. Retrieved from <https://writing.colostate.edu/guides/guide.cfm?guideid=61>
- Chen, H., Chiang, R. H. L., & Storey, V. C. (2012). Business intelligence and analytics: From big data to big impact. *MIS Quarterly*, 36(4), 1165-1188. <https://doi.org/10.2307/41703503>
- Guo, Y., & Liang, C. (2016). Blockchain application and outlook in the banking industry. *Financial Innovation*, 2(1), 1-12. <https://doi.org/10.1186/s40854-016-0034-9>
- Tapscott, D., & Tapscott, A. (2016). *Blockchain revolution: How the technology behind bitcoin is changing money, business, and the world*. Penguin Random House.
- Brynjolfsson, E., & McAfee, A. (2017). The business of artificial intelligence: What it can—and cannot—do for your organization. *Harvard Business Review*, 95(4), 110-119.
- Jain, P., & Bansal, P. (2017). Real-time payment systems and financial inclusion: A case study of India's UPI. *Journal of Payments Strategy & Systems*, 11(4), 307-318.
- Pwc. (2017). Global fintech report: Redrawing the lines: FinTech's growing influence on financial services. Retrieved from <https://www.pwc.com/gx/en/industries/financial-services/assets/pwc-global-fintech-report-2017.pdf>
- Risius, M., & Spohrer, K. (2017). A blockchain research framework: What we (don't) know, where we go from here, and how we will get there. *Business & Information Systems Engineering*, 59(6), 385-409. <https://doi.org/10.1007/s12599-017-0506-0>
- Gai, K., Qiu, M., & Sun, X. (2018). A survey on fintech. *Journal of Network and Computer Applications*, 103, 262-273. <https://doi.org/10.1016/j.jnca.2017.10.011>
- Kumar, R., & Jaiswal, R. (2018). Adoption of artificial intelligence in the banking sector: An overview. *International Journal of Advanced Research in Computer Science*, 9(2), 524-529. <https://doi.org/10.26483/ijarcs.v9i2.5649>
- Olhede, S. C., & Wolfe, P. J. (2018). The growing ubiquity of algorithms in society: Implications, impacts, and innovations. *Proceedings of the National Academy of Sciences*, 115(50), 12590-12597. <https://doi.org/10.1073/pnas.1809354115>
- Stulz, R. M. (2019). Fintech, bigtech, and the future of banks. *Journal of Applied Corporate Finance*, 31(4), 86-97. <https://doi.org/10.1111/jacf.12372>

- World Bank. (2019). Payment systems worldwide: A snapshot. Retrieved from <https://www.worldbank.org>
- Bank for International Settlements. (2020). Enhancing cross-border payments: Building blocks of a global roadmap. Retrieved from <https://www.bis.org>
- Mizuho Bank. (2020). The future of real-time payments: Trends and predictions. Mizuho Research Institute Report. Retrieved from <https://www.mizuhobank.com/research>
- Clearing House. (2021). Real-time payments. Retrieved from <https://www.theclearinghouse.org/payment-systems/rtp>
- Federal Reserve. (2021). FedNow Service. Retrieved from https://www.federalreserve.gov/paymentsystems/fednow_about.htm
- Arun, M., & Selvan, R. T. (2021). Artificial intelligence in fintech: Adoption and application in payment systems. *Journal of Financial Services Research*, 59(3), 451-472. <https://doi.org/10.1007/s10693-020-00340-6>
- Reserve Bank of India. (2022). Annual Report. Retrieved from <https://www.rbi.org.in/scripts/AnnualReportPublications.aspx>
- National Payments Corporation of India. (2023). Unified Payments Interface (UPI). Retrieved from <https://www.npci.org.in/what-we-do/upi/product-overview>
- Vaismoradi, M., Turunen, H., & Bondas, T. (2013). Content analysis and thematic analysis: Implications for conducting a qualitative descriptive study. *Nursing & Health Sciences*, 15(3), 398-405.
- Shukla, A. (n.d.). Questionnaire for adoption of mobile wallet. Retrieved from <https://www.scribd.com/document/335450629/Questionnaire-For-Adoption-of-Mobile-Wallet>
- LeCun, Y., Bengio, Y., & Hinton, G. (2015). Deep learning. *Nature*, 521(7553), 436-444. <https://doi.org/10.1038/nature14539>

Appendix

Respondent	Location	Age	Industry Type	Designation	Gender	Use Mobile Payment	Which Application	Ratings out 5	How frequency	Challenges	Solutions Tried	Expected Solutions
1	Boston	26	Business	Owner	Male	Yes	Zelle	4	Daily	Tracking	Can't try anything	User Friendly Dashboard
2	Boston	31	Employed	Lead	Female	Yes	Venmo	1	Daily	Scams	Can't try anything	Anti Virus Integration in mobile apps
3	Boston	33	Business	Owner	Female	Yes	Zelle	2	Weekly	Waiting timeline for customer care	Can't try anything	Adopt Bots on customer care
4	Boston	45	Business	Owner	Female	Yes	G Pay	4	Weekly	Waiting timeline for customer care	Can't try anything	Adopt Bots on customer care
5	Boston	30	Business	Owner	Male	Yes	Zelle	4	Daily	Scams	Raised Ticket	Anti Virus Integration in mobile apps
6	Boston	29	Business	Owner	Male	Yes	G Pay	3	Daily	Scams	Raised Ticket	Anti Virus Integration in mobile apps
7	Boston	25	Employed	Analyst	Male	Yes	Zelle	1	Daily	Scams	Raised Ticket	Anti Virus Integration in mobile apps
8	Boston	28	Employed	Analyst	Male	Yes	Samsung Pay	4	Daily	Scams	Raised Ticket	Anti Virus Integration in mobile apps
9	Boston	31	Employed	Analyst	Male	Yes	Zelle	4	Daily	Scams	Raised Ticket	Anti Virus Integration in mobile apps
10	Boston	35	Employed	Analyst	Female	Yes	Apple Pay	4	Weekly	Scams	Raised Ticket	Anti Virus Integration in mobile apps
11	Boston	29	Business	Owner	Female	Yes	Venmo	4	Daily	Duplicate IDs	Raised Ticket	Integrate Unique Identification Number
12	Boston	22	Employed	R&D	Female	Yes	Zelle	2	Daily	Duplicate IDs	Raised Ticket	Integrate Unique Identification Number
13	Boston	32	Employed	R&D	Female	Yes	G Pay	4	Daily	Duplicate IDs	Raised Ticket	Integrate Unique Identification Number
14	Boston	35	Employed	Senior Analyst	Male	No	NA	0	NA	NA	NA	NA
15	Boston	28	Employed	Senior Analyst	Female	No	NA	0	NA	NA	NA	NA
16	Boston	31	Employed	Senior Analyst	Male	Yes	Zelle	4	Daily	Duplicate IDs	Call Customer Care	Integrate Unique Identification Number
17	Boston	33	Business	Owner	Female	Yes	Venmo	3	Weekly	Duplicate IDs	Call Customer Care	Integrate Unique Identification Number
18	Boston	45	Business	Owner	Male	Yes	Zelle	4	Weekly	Duplicate IDs	Raised Ticket	Integrate Unique Identification Number
19	Boston	30	Employed	Lead	Male	Yes	Venmo	3	Daily	Duplicate IDs	Call Customer Care	Integrate Unique Identification Number
20	Boston	29	Business	Owner	Male	No	NA	0	NA	NA	NA	NA
21	Bengaluru	29	Business	Owner	Female	Yes	Phone Pe	4	Daily	Tracking	Call Customer Care	User Friendly Dashboard
22	Bengaluru	25	Business	Owner	Male	Yes	QRED	4	Daily	Tracking	Call Customer Care	User Friendly Dashboard
23	Bengaluru	28	Business	Owner	Female	Yes	Phone Pe	4	Daily	Waiting timeline for customer care	Try a new App	Adopt Bots on customer care
24	Bengaluru	31	Employed	Analyst	Male	Yes	Phone Pe	1	Daily	Waiting timeline for customer care	Raised Ticket	Adopt Bots on customer care
25	Bengaluru	33	Employed	Analyst	Female	Yes	G Pay	4	Weekly	Waiting timeline for customer care	Try a new App	Adopt Bots on customer care
26	Bengaluru	45	Employed	Senior Analyst	Male	No	NA	0	NA	NA	NA	NA
27	Bengaluru	30	Employed	Senior Analyst	Male	Yes	Phone Pe	4	Daily	Tracking	Raised Ticket	User Friendly Dashboard
28	Bengaluru	29	Employed	Senior Analyst	Male	Yes	Phone Pe	3	Daily	Tracking	Try a new App	User Friendly Dashboard
29	Bengaluru	25	Business	Owner	Male	Yes	Phone Pe	4	Daily	Tracking	Try a new App	User Friendly Dashboard
30	Bengaluru	29	Business	Owner	Male	Yes	Phone Pe	1	Daily	Tracking	Call Customer Care	User Friendly Dashboard
31	Bengaluru	22	Employed	Analyst	Female	Yes	Gpay	1	Daily	Scams	Call Customer Care	Anti Virus Integration in mobile apps
32	Bengaluru	32	Employed	Analyst	Female	Yes	Phone Pe	3	Daily	Scams	Call Customer Care	Anti Virus Integration in mobile apps
33	Bengaluru	29	Employed	Analyst	Female	Yes	G Pay	2	Daily	Scams	Call Customer Care	Anti Virus Integration in mobile apps
34	Bengaluru	22	Employed	R&D	Male	Yes	Phone Pe	1	Daily	Scams	Call Customer Care	Anti Virus Integration in mobile apps
35	Bengaluru	32	Employed	R&D	Female	Yes	Phone Pe	5	Daily	Scams	Can't try anything	Anti Virus Integration in mobile apps
36	Bengaluru	33	Employed	R&D	Male	Yes	Airtel Pay	2	Weekly	Scams	Can't try anything	Anti Virus Integration in mobile apps
37	Bengaluru	45	Business	Owner	Female	No	NA	0	NA	NA	NA	NA
38	Bengaluru	30	Business	Owner	Male	Yes	Phone Pe	4	Daily	Waiting timeline for customer care	Can't try anything	Adopt Bots on customer care
39	Bengaluru	29	Business	Owner	Female	Yes	BHIM	3	Daily	Waiting timeline for customer care	Can't try anything	Adopt Bots on customer care
40	Bengaluru	25	Business	Owner	Female	Yes	Phone Pe	5	Daily	Waiting timeline for customer care	Can't try anything	Adopt Bots on customer care