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Enhancing Cashless Transactions: The Role and Benefits of Fingerprint Technology

Saurav Gupta[1], Dr. Priyanka Gupta[2]

[1]Chitkara University Institute of Engineering and Technology, Chitkara University, Punjab, India
saurav1828.be21@chitkara.edu.in

[2]Chitkara University Institute of Engineering and Technology, Chitkara University, Punjab, India
gupta.priyanka@chirkara.edu.in

Abstract: ***In the modern times cashless transactions have become increasingly prevalent in today's digital economy and strong security measures are important to safeguard all the sensitive data related to finances. Fingerprint recognition emerges as a safe solution to upgrade the security and convenience of existing cashless systems. This research paper explores the utilization and benefits of fingerprint recognition./ The paper begins by understanding the basics of this technology, its advancement and uses. It then dives into the integration of cashless transactions with fingerprint recognition systems highlighting the potential benefits. Moreover, this paper also analyzes real-word scenarios and implementation across various industries and geographies. Furthermore, the technical considerations and challenges associated with implementation are also discussed which includes scalability, accuracy, accessibility of the technology. The strategies to make this technology more efficient and compliant are also discussed. In conclusion, this research accentuates the potential to revolutionize the landscape of cashless transactions using fingerprint recognition technology. By addressing and solving the challenges the full potential of biometric technology to upgrade digital payments can be unlocked.***

Keywords: fingerprint recognition, Cashless transactions, Biometric authentication, Security, Privacy

1. Introduction

The Unified Payments Interface (UPI) was introduced in 2016 by National Payments Corporation of India (NPCI) and has since gained widespread acceptance all over the country. It has not only simplified the banking system but also added millions of unbanked Indians into the system. Automated Fingerprint Identification System (AFIS) was introduced in 1980s with is first being used to identify criminals.

a) Integration of banking system and AFIS

This integration started with the Introduction of Aadhar card in 2016 which is a biometric ID card and has features like eKYC (electronic know-your-customer) which helps the holder of this card to open a bank account and by this an account holders`s fingerprints were linked with the bank account.

b) UPI in India

In this interface an under`s multiple bank accounts are merged into one single mobile application enabling seamless routing and transfer of funds. In 2023 UPI crossed the 100 billion mark and is projected to account for 90% of the total total transaction volume in retail digital payments from 2023 to 2028. Apart from India UPI has also been introduced in Sri Lanka and Mauritius as well as France, UAE, Singapore, Nepal and Bhutan.

2. Problem Formulation

The incorporation of fingerprint recognition technology in cashless transactions involves multiple levels of development in areas such as technology, banking and regulations. Although since the introduction of UPI it has gained widespread acceptance throughout the country but these challenges need to be addressed and resolved in order to develop this technology and achieve seamless integration and sustainability. This research aims to investigate the following key issues:

1) Technological Challenges:

- What type of hardwares and softwares that are need to be developed and patented in order to incorporate fingerprint technology into this system?
- What are the key roadblocks that stand in the way of widespread application of this technology, in particular, in relation to supply, installation and sustainability? Moreover, what avenues can be used to surpass these roadblocks?

2) Banking Institutions and Consumer Dynamics:

- What are the steps needed to convince banking institutions to share the fingerprint data of its consumers obtained during KYC for authentication purposes?
- What are the methods needed to convince the payers to incorporate this technology during monetary transactions?

3) Regulatory and Policy Framework:

- What are the government policies and regulations required for successful implementation?
- In order to expand and further develop this technology what are the regulatory frameworks that should be put in place to make it possible?

4) Future Projections and benefits:

- Will this ease in doing monetary transactions give a boost to a country's economy?
- In future due to the increase in these types of payment methods will the dependency on paper money, plastic money be reduced or in some cases will be erased?

3. Objectives

The objectives of this research project includes the following:

1) To outline the previous development in cashless transactions since its introduction in 2016 and its future in order to make the process even seamless.
2) To evaluate the present advancements and resources required for the future advancements in this field.
3) To analyze the factors and material required for software development and hardware developments for implementation.
4) To assess the economic advantages and disadvantages of cashless transactions in boosting a country's economy.
5) To examine the economic effects of this transition on banking systems and consumer behavior.

4. Literature Survey

Recent years have seen a major increase in interest in the use of biometric identification techniques, such as fingerprint recognition, in cashless transactions. The purpose of this literature review is to present a thorough summary of the research results pertaining to the application of fingerprint recognition systems in cashless transactions. In addition to highlighting knowledge gaps and proposing possible future study topics, the review will combine and synthesize the current research insights.

a) Models of Biometric Authentication

In order to comprehend the aspects impacting the adoption of electronic transactions, Al-gahtani (2011) suggested an expanded technology acceptance model. This model provides a fundamental framework for investigating the use of fingerprint recognition and other biometric identification techniques in cashless transactions. The study highlights how crucial user trust and acceptance are to the effectiveness of biometric-based systems.

Moreover, the Swing-Pay digital card module—which enables peer-to-peer payments via NFC and biometric authentication—was shown by Ghosh et al. (2017). This creative method shows how fingerprint recognition can be used to improve the usability and security of cashless transactions.

b) Biometric Identifiability and Sensor Properties

Prabhakar et al. (2011) conducted a study on sensor characteristics and image quality in biometric recognition systems. Their research primarily focuses on the technological aspects of fingerprint sensors, but understanding the reliability and effectiveness of fingerprint recognition in cashless transactions is aided by the findings. Further research could look on optimizing sensor configurations to increase biometric authentication accuracy and efficacy in real-world payment scenarios.

c) Verification of Biometrics through Mobile Sensors

Tan and Perkowski (2017) proposed a two-stage classifier technique to enhance electrocardiogram (ECG) biometric verification using mobile sensors. Although their work focuses on ECG biometrics, similar techniques and insights can also be applied to fingerprint identification systems. This might be used in future research to investigate the integration of various biometric modalities, such fingerprint and ECG, for trustworthy multifactor authentication in cashless transactions.

5. Methodology

A. Quantitative research methodology: Numerical data measurement and testing are the main goals of quantitative research technique. This strategy works well for quickly contacting a big number of people. This kind of study aids in prediction-making, examining the causal links between variables, and extrapolating findings to larger populations. The methodology is structured into multiple key components:

1) Literature Review: It is important to do intensive research on the existing literature that focuses on history and development of cashless transactions and fingerprint technology.
2) Technological Analysis: Research the progress that has been made in the hardware and software department in order to increase the efficiency of the system which led to such widespread acceptance of this technology.
3) Economic Impact: Highlight the economic impact which took place due to the implementation of this method of monetary transaction and predict further impact after more development of this technology.
4) Policy Analysis: Assess the impact of policies and regulations that the government has implemented that boost the adoption of methods such as biometric authentication and cashless methods such as UPI.

6. Discussion

1) Benefits of fingerprint recognition

Within the context of cashless transactions, fingerprint recognition provides a number of significant benefits. First of all, because each person's fingerprint is distinct, it offers a high degree of security by making it harder for unauthorized users to access another person's account. By doing away with the requirement for passwords or PINs, this biometric authentication technique lowers the possibility of fraud and identity theft. Furthermore, users using fingerprint recognition only need to place their finger on a scanner to complete a transaction, making it a quick and easy process. For businesses, this convenience element can expedite the payment process and improve the whole client experience.

2) Potential Challenges

Despite its many benefits, the adoption of fingerprint recognition technology in cashless transactions may face several challenges. One major concern is the issue of privacy and data security. Users may be hesitant to share their biometric information with financial institutions or third-party service providers due to fears of data breaches or misuse of their personal data. Moreover, there may be technological barriers such as compatibility issues with existing payment systems and the need for costly hardware upgrades to implement fingerprint scanners.

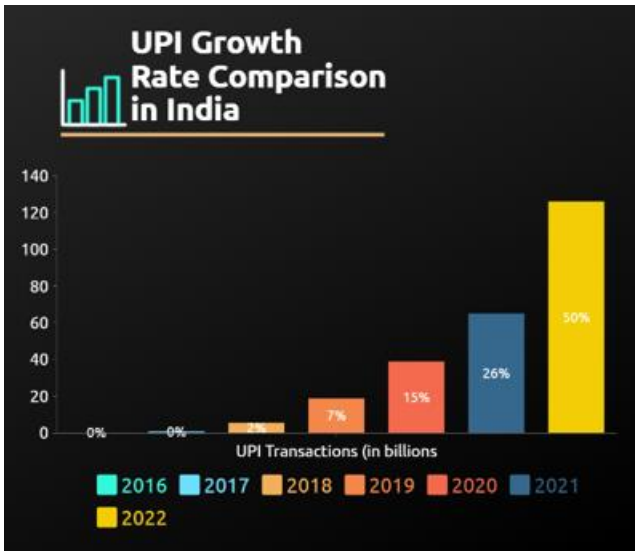
Additionally, there could be societal resistance to biometric identification methods, with some individuals expressing concerns about the potential for surveillance or loss of privacy.

3) Application Examples

Cashless transactions in a number of industries could be revolutionized by fingerprint recognition technology. For example, fingerprint scanners could be added to point-of-sale terminals in the retail industry to facilitate safe and effective payment processing. In the banking sector, fingerprint authentication may be used by ATMs and smartphone banking apps to improve transaction security and stop illegal

account access. Furthermore, contactless payments for medical services could be made by patients using fingerprint identification in the healthcare industry, guaranteeing safe and easy transactions.

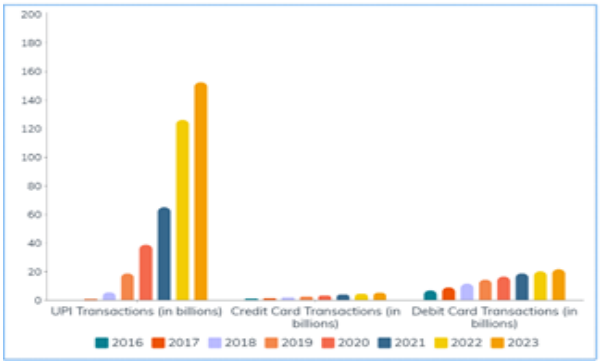
7. Figures and tables



Graph 1.1

Table 1.1

Year	UPI Transactions (in billions)
2016	0.02
2017	0.74
2018	5.35
2019	18.7
2020	38.8
2021	64.9
2022	126



Graph 1.2

Table 1.2

Year	UPI Transactions (in billions)	Credit Card Transactions (in billions)	Debit Card Transactions (in billions)
2016	0.02	1.11	6.83
2017	0.74	1.45	8.92
2018	5.35	1.97	11.51
2019	18.69	2.56	14.29
2020	38.78	3.21	16.47
2021	64.93	3.89	18.72
2022	126	4.52	20.11
2023	152.34	5.21	21.58

As we can observe by the above graphs and data table that the increase in cashless transactions has been increasing year on year since its introduction in 2016 in India. In FY22 around 126 billion transactions took place which was almost double that from FY22 with 64.93 billion. Although we see this exponential growth in UPI transactions we can see that there is gradual increase in credit card and debit card transactions with which we can see the decreasing dependency on paper money by the consumers. Since all of these transactions are monitored by the banks and government it gives a high standard of security and provides an intensive tracking of monetary movement.

[Graphs included: Graph 1.1 , Graph 1.2 and Data Tables included: Table 1.1 , Table 1.2]

8. Conclusion

To sum up, there are a lot of advantages and disadvantages to using fingerprint recognition technology for cashless transactions in India. On the one hand, people can transact easily and securely using technology without requiring actual cards or passwords. This has the potential to improve financial inclusion, particularly for those who lack bank accounts. However, because fingerprints can be stolen or used improperly, there are privacy and data security concerns. A large-scale implementation of such a system might also be too costly for a lot of companies and individuals. However, there is a good chance that fingerprint recognition technology will transform cashless transactions in India provided it is properly regulated and supervised. It will be essential to conduct more research and work with corporations, governments, and technological companies.

9. Future Scope

The future of cashless transactions are very bright as we have seen the trend of growing adoption and usage of this technology by consumers which is benefitting the government as well as the banks. Further with the development in this technology by incorporating a fingerprint recognition system with Pos machines increasing the ease of doing transactions will boost its usage and security of this system.

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