



# A Case study on Cheque clearance system through blockchain





# MudraChain: Blockchain-based framework for automated cheque clearance in financial institutions

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## ABSTRACT

Currently, the burden on the cheque clearing houses in financial institutions is increasing day-by-day, which necessitates the upgrading of the existing cheque truncation system (CTS). It is a manual process which uses Magnetic Ink Character Recognition (MICR), where cheques have been scanned and sent to the clearing house for further processing. The limitations of existing CTS are — illegal duplication of cheque images, invisible ink usage, visibility issues in beneficiary name, and amount on the cheque. To handle the aforementioned issues of the existing CTS, blockchain has emerged as a new technology which is a distributed ledger that is timestamped and immutable. Being immutable, forgeries related to images of cheques during clearance cycles are not allowed. This provides trust and consensus among all participating entities in the network. Motivated by the above discussion, in this paper, we propose a framework named *MudraChain* for automated cheque clearance, where clearance operations are handled by the blockchain network, instead of existing CTS. It includes: (i) A multi-level authentication scheme to make the blockchain-based framework secure and tamper-proof among participating financial stakeholders, (ii) A quick-response (QR) code generation algorithm which performs digital signing of a cheque, and (iii) A novel two-factor authentication protocol to generate a time based one-time password (TOTP) for secure funds transfer. The obtained results are examined against state-of-the-art approaches to indicate the supremacy of the proposed framework. Thus, *MudraChain* allows a seamless flow of clearance operation via blockchain for the payer and the payee without any intermediaries. Finally, it addresses the requirements of building a secure application for cheque clearance in view of decentralized blockchain 4.0 applications.

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# Background

Financial institutions are shifted towards digital wallets and payments, hence ***Trade*** becomes a critical factor.

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MICR system focuses on Watermarks, UV Light and other microscopic features to scan a cheque.



Problem with traditional CTS....

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## Problem with traditional CTS....

- CTS has limited functionality.
- It checks only the greyscale image of cheque which reduces the visibility of MICR features.
- Features can be duplicated with photo editing software and forged cheque can be created.
- Leads to wrong payment by the bank to the malicious user.



Problem with traditional CTS....

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# Problem with traditional CTS....

- Possible security frauds with traditional CTS
  - ✓ *Duplication of cheque images*
  - ✓ *Invisible ink usage*
  - ✓ *Visibility issues in beneficiary name*
  - ✓ *Visibility issues with amount on the cheque*



Problem with traditional CTS....

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## Problem with traditional CTS....

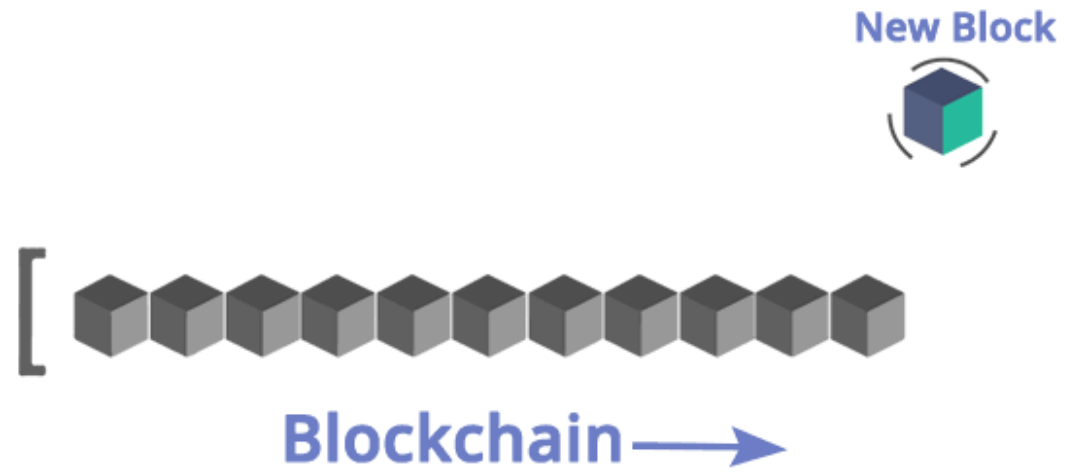
- Delay in cheque clearing for non-CTS branches.
- Cheques are sent via the postal system to non-CTS branches.
- This leads to the loss of physical evidence.

Another problem is **Centralized Cheque Clearing System**

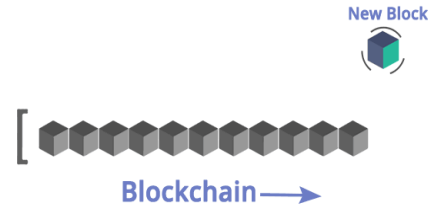
All these limitations of traditional CTS  
creates the need for secure and automated  
system

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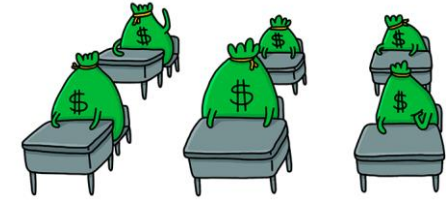
Possible  
Solution...



# Possible Solution....

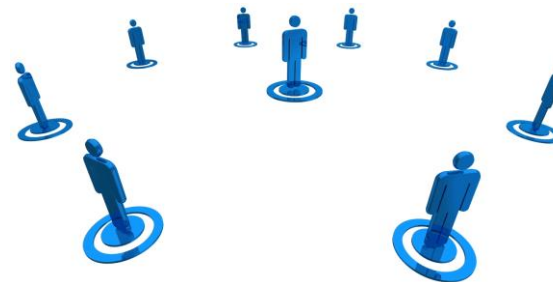


Integration of  
Blockchain in  
clearing process.

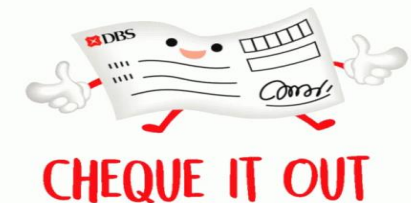


Distributed and  
immutable.

Leads to  
transparency.



Increases the  
efficiency of  
cheque clearing



# Blockchain Enabled Cheque




Blockchain enabled cheque will be presented to the users of the bank which can operate in ***Consortium*** mode.



Cheque is embedded with a QR code.



QR code is generated by encrypting bits with the issuer private key  $K$ .

<b>NPA Bank Limited</b>		<b>Date:</b> DD/MM/YYYY	
<b>XYZ nagar</b>		<b>Valid for 3 months only</b>	
Pay _____		or Bearer	
Rupees _____			
		अदा करे	₹ <input type="text"/>
A/C No.	XXXXXXXXXXXX		Mr. XXXYYYZZZ
MULTY-CITY CHEQUE Payable at Par at All Branches of NBL			Please sign above
"12XXX7" 4XXXXXXXX8 : 6XXXX8 6X			

# Blockchain Enabled Cheque

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The wallet operates in ***Consortium*** mode and is accessible to only the beneficiary.

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It is developed in Hyperledger Fabric which mainly uses ***Practical Byzantine Fault Tolerance (PBFT)***.

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PBFT provides a mechanism for the files to communicate even after one of the files is corrupted.

# Blockchain Enabled Cheque



A blockchain cheque runs smart contracts called ***Chaincode*** in ***Hyperledger Fabric***.



Chaincode are written in programming languages such as ***Go or Node***.



Chaincode separates various entities participating in a financial transaction.



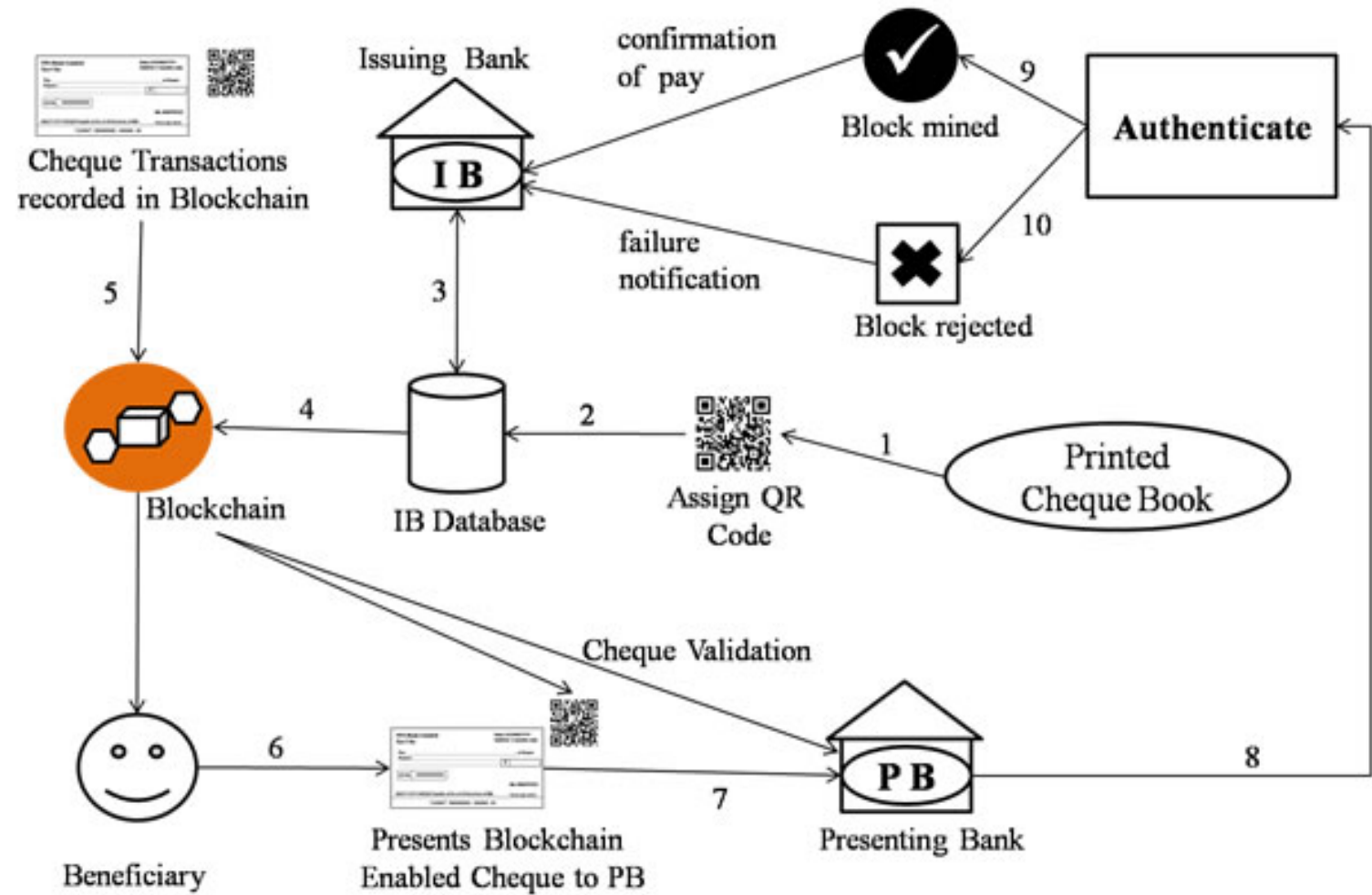
Log of encrypted transaction is ***untraceable*** for normal parties in the chain.

# Comparison of Traditional Wallet (Bitcoin) Vs Blockchain Cheque System



Features	Traditional Wallet (Bitcoin)	Blockchain cheque	Description
Nature	Public	Consortium	Service-oriented and flexible anonymous transaction system.
Smart Contracts	No	Yes	Programming Languages like Cotlin/NodeJs/Python/Solidity
Encryption	Single	Multiple	Public Source Addresses and Destination Addresses, or even anonymous accounts.
Identity Authentication	No	Yes	Permissioned chain
Verification Time	10 milliseconds	10 microseconds	GPU based parallel computational models available

## Possible System with Blockchain



# Enhancing Security of Blockchain enabled Cheque Clearance System



- Generation of QR Codes.
- Two-Factor authentication of the Blockchain Enabled Cheque.
- Auto-Verification of OTP and transfer of Funds.

# Smart vs. Intelligent



The difference between a smart man and a wise man is that a smart man knows what to say, a wise man knows whether or not to say it...

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*If you had a graph in which the **x axis represented situations** and the **y axis the outcome**, the graph of the wise person would be high overall, and the graph of the smart person would have high peaks.*

