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Securing Unrecorded Physical Transactions

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Abstract: Every day, we perform many transactions, some of which are recorded and some of which are not. Recorded transactions are those that have a physical record maintained, such as online transactions or bank loans. Unrecorded transactions are those that do not have a record maintained, such as most physical transactions. Unrecorded transactions are difficult to verify, which makes them susceptible to fraud. This paper proposes a solution for preventing fraud in physical unrecorded transactions by digitalizing their record using blockchain and developing a model of transaction which will secure the record of transaction and ensure that money is actually being transferred. This solution has a number of potential benefits, including reducing the number of victims of fraud, saving businesses money, and improving public trust in the financial system.
Keywords: Recorded transactions, Unrecorded transactions, blockchain, digitalizing

I. INTRODUCTION

In our daily lives, transactions are an integral part of our financial interactions, encompassing a wide range of exchanges, from everyday purchases to substantial financial commitments. Yet, a significant portion of these transactions occurs without proper documentation, leaving a void in the trail of evidence needed for future validation. In stark contrast, transactions carried out through traditional financial institutions, like loans from banks, are meticulously documented, ensuring the credibility and accountability of all parties involved. Regrettably, the absence of such meticulous records in unrecorded transactions poses a formidable challenge, casting doubt on the veracity of these exchanges.

Consider a scenario where Bob lends 1000 Rs to Alice for a month, only to find Alice disputing the terms upon repayment, claiming to have borrowed only 800 Rs. In these instances, the absence of concrete legal proof leaves Bob with little recourse to challenge Alice's assertion, opening the door to potential disputes and accusations of fraud.

The emergence of digitalization promises a potential solution to these dilemmas by enabling the systematic recording of transactions. However, mere digitalization is not the panacea; it is but the first step. To truly fortify transaction security and integrity, a robust transaction model is imperative. Such a model must not only assure the secure transfer of funds to their intended recipients but also institute mechanisms for verifying the identities of those partaking in the transactions. By doing so, trust and accountability can be reinstated in the realm of financial exchanges. In this paper, we introduce an innovative transaction model that hinges upon the mutual agreement of transaction conditions between lenders and borrowers, the principal actors in the transaction process. Central to this model is the meticulous documentation of transaction proof, securely preserved within the transaction record and stored on the blockchain alongside other essential transaction details. Leveraging the power of blockchain technology represents a significant stride towards fortifying transaction records' security. Blockchain's inherent attributes—transparency, immutability, and heightened security—constitute the bedrock upon which we build the fortress of transaction safeguarding.

II. LITERATURE REVIEW

The emergence of blockchain technology has sparked considerable interest and innovation in various sectors, including finance, supply chain management, and healthcare. This literature review aims to provide an overview of key studies and developments related to blockchain technology, its applications, and its impact on secure transactions. By examining existing research, we aim to identify gaps in knowledge and set the stage for our proposed research on enhancing transaction security in physical transactions through blockchain technology.

A. Blockchain Technology: Concepts and Foundations

Blockchain technology, initially introduced in Nakamoto's seminal whitepaper [1], underpins the foundation of cryptocurrencies like Bitcoin. It is characterized by its decentralized, distributed ledger system, which records transactions in a secure and tamper-resistant manner. This technology has since evolved to encompass various consensus mechanisms, smart contracts, and decentralized applications [2].

B. Applications of Blockchain Technology
The literature reveals a diverse range of applications for blockchain technology. In the financial sector, blockchain has been explored for secure and transparent cross-border payments and digital asset management [3]. Additionally, supply chain management has witnessed the integration of blockchain to enhance transparency, traceability, and accountability [4]. Healthcare, too, has seen innovations such as blockchain-based health records to improve data security and interoperability [5].

C. Blockchain and Secure Transactions
One of the prominent advantages of blockchain technology is its potential to secure transactions. A study by Swan [6] highlights the cryptographic techniques used in blockchain to ensure the integrity and confidentiality of transaction data. The immutability of blockchain records and the decentralized nature of the network contribute to enhanced security [7].

D. Challenges and Limitations
Despite its potential, blockchain technology is not without challenges. Scalability issues [8], energy consumption concerns [9], and regulatory hurdles [10] have been subjects of extensive research and debate.
While blockchain's application in securing digital transactions is well-documented, there is a notable gap in research concerning its implementation in enhancing the security of physical transactions. Our research seeks to address this gap by proposing a practical system for securing physical transactions through blockchain technology.

III. CHALLENGES IN SECURING PHYSICAL TRANSACTIONS
Securing physical transactions presents a range of intricate challenges that demand meticulous consideration:

A. Clear Mutual Agreement
Ensuring both parties involved in a transaction reach a mutual understanding regarding the terms and conditions is paramount. For instance, in loans, where interest rates and payback periods can vary significantly, it's crucial to establish a comprehensive and explicit agreement within the transaction record before any monetary exchange occurs.

B. Ensuring Irrevocable Fund Transfers:
A central and pivotal challenge lies in guaranteeing that our secure transaction model not only facilitates secure fund transfers but also does so in an irrevocable manner. The significance of this lies in the irrefutable commitment that occurs once a transaction record is established within the system. This means that once a transaction is recorded, none of the involved parties can deny their roles or make false claims. For instance, the lender cannot deny making the payment, and the borrower cannot disavow receiving it. Furthermore, the system ensures that no fraudulent claims can be made, preventing scenarios where the borrower falsely claims non-receipt or the lender falsely asserts fund transfer. By solidifying this commitment, we fortify the integrity of the entire transaction process.

C. Evidentiary Records
The transaction record should incorporate irrefutable proof that the claimed transaction has indeed transpired. This proof serves as a safeguard against disputes and fraudulent claims, offering assurance and accountability in the transactional ecosystem.

D. Enhancing Transaction Record Security:
Ensuring the security of transaction records post-transaction is a paramount aspect of our system's integrity. The sanctity of these records must be maintained, as any subsequent modification would render the system's integrity compromised. Thus, safeguarding transaction record security stands as a cornerstone of our approach to system security.
Addressing these challenges is essential to fortify the security and trustworthiness of physical transactions and to enable a seamless transition to a digitalized record-keeping system.

IV. PROPOSED SYSTEM
Addressing the challenges inherent in securing physical transactions, we have devised a comprehensive transaction model comprised of three distinct phases:

A. Phase 1: Transaction Creation

The transaction initiation process commences with the lender creating a transaction request. This request includes critical details such as the transaction amount, transaction name, payback duration, repayment amount, and other pertinent information. Subsequently, the created transaction becomes visible to both the lender and borrower, residing in the 'Initiated' and 'Pending' transaction sections, respectively.

B. Phase 2: Agreement on Transaction Conditions

Upon the lender's creation of the transaction request, it is transmitted to the borrower for review. The borrower carefully examines all details presented in the transaction request. If the borrower concurs with the specified transaction conditions, they accept the request. Once accepted, the transaction enters a partially committed state.

C. Phase 3: Transaction Commitment

During this pivotal phase, the actual transfer of funds takes place. The borrower meticulously verifies the transferred amount upon receipt. Simultaneously, the lender employs the application to capture an image of the transaction, ensuring visual documentation of the exchange. This photographic evidence is securely stored alongside the transaction record, serving as irrefutable proof of the transaction's occurrence, substantiating that the lender disbursed the funds, and the borrower received them. At this pivotal juncture, the transaction record finds its permanent home within the blockchain. The blockchain, with its immutable nature, stands as the fortress safeguarding the integrity and security of these transaction records.

To maintain the integrity of the system, a safeguard is in place: if the lender fails to upload the required proof within a 24-hour timeframe, the transaction becomes invalid and is promptly removed from the system. Conversely, successful proof upload within the stipulated time period culminates in the transaction being permanently recorded in the system.

Upon repayment, the same model is replicated, with the borrower taking on the role of the lender, creating the transaction request. This process ensures consistency and adherence to the responsibilities established during the initial lending phase, ultimately facilitating a successful transaction completion.

V. METHODOLOGY

In this section, we describe the step-by-step methodology for our research, outlining the process by which transactions are securely recorded and executed in our proposed system.

1) *Step 1:* User Authentication and Identity Verification

a) *Login and Phone Number Verification*

- Users initiate the process by logging in to the system.
- Phone number verification is essential, serving as a unique identifier for users and ensuring the integrity of transaction records. It establishes a link between the user's identity and their transactions.

2) *Step 2:* Transaction Initiation by Lender

a) *Transaction Creation*

- Lenders create transaction requests during Phase 1.
- Transaction details, excluding photographic proof, are stored in the database.
- The transaction status code field in the database signifies the current phase of the transaction.

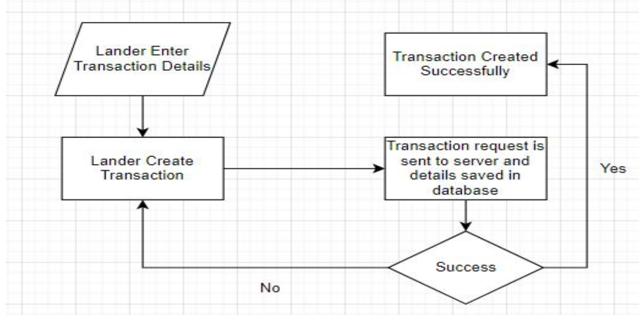

Fig. 1. Flow Chart Depicting Transaction Creation

3) *Step 3:* Borrower Acceptance of Transaction Terms

a) *Agreement to Transaction Conditions*

- Borrowers review transaction terms and conditions in Phase 2.
- Upon agreement, a request is sent to update the transaction record's status to a partially committed state.
- Successful status update signifies progression to the final phase.

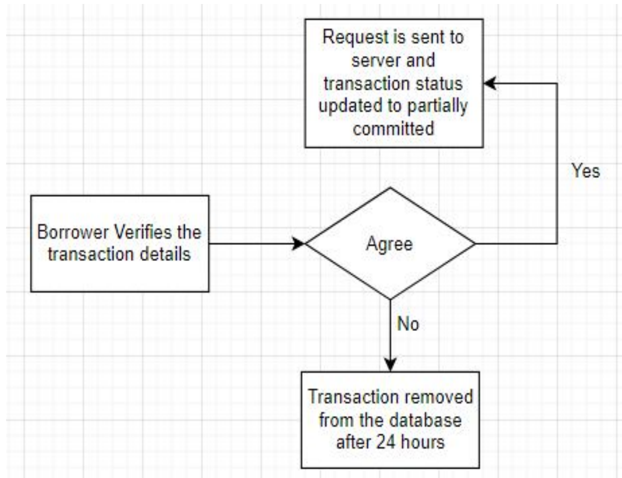

Fig. 2. Flow Chart Depicting Transaction Agreement

4) *Step 4:* Transaction Commitment

a) *Photographic Proof and Data Storage*

- Lander capture photographic proof of the transaction in this phase.
- The photographic evidence is securely transmitted to the backend server for storage.
- Simultaneously, the original transaction record created in Phase 1 is retrieved from the database.

b) *Blockchain Integration*

- A hash is calculated for the photographic proof.
- The hash, along with transaction details, is recorded in the blockchain, ensuring data integrity and transparency.
- Successful blockchain integration signifies the transaction as fully committed.

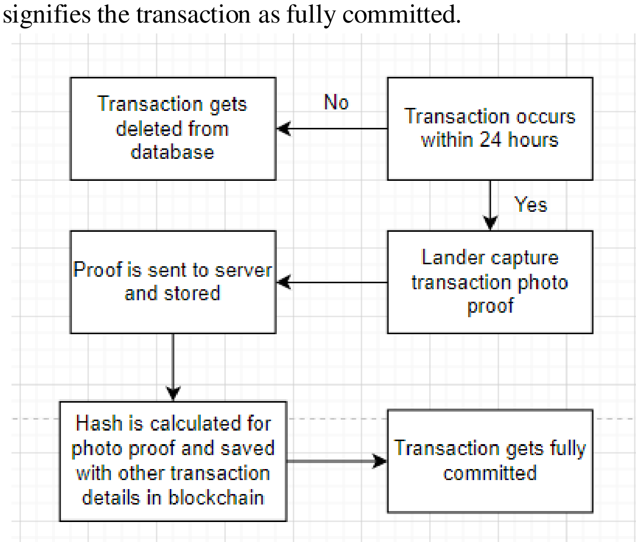

Fig. 3. Flow Chart Depicting Transaction Commitment

VI. RESULTS AND DISCUSSION

The In our pursuit of enhancing transaction security in physical exchanges, we've diligently brought our vision to life through the development of an Android application built using React Native. The server, powered by Express, works seamlessly in tandem with a MySQL database, forming the backbone of our secure transaction model. As we delve into the following sections, we embark on a journey to explore the different phases of our transaction model, offering insights into the practicality, functionality, and user experience of our application. Accompanied by illustrative app screenshots, we unravel the layers of innovation that underlie each transaction phase, marking a significant step forward in the realm of secure physical transactions.

The initial phase of our application seamlessly integrates user authentication and phone number verification. Users can access the application by conveniently logging in with their Google account credentials. Once logged in, an additional layer of security is introduced through phone number OTP (One-Time Password) Jverification, enhancing the overall authentication process.

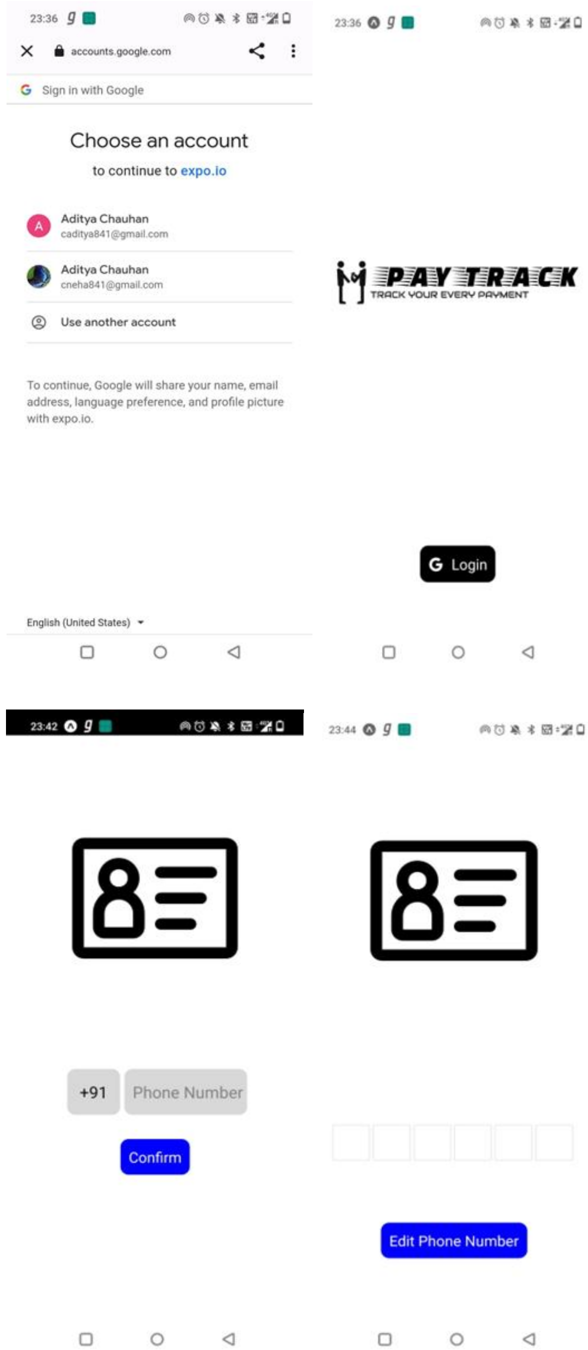

Fig. 4. App Screenshots depicting login and phone number OTP verification

A. Transaction Phase 1: Transaction Creation

Within this pivotal phase, the "lander" assumes the role of initiator by crafting a new transaction within the application's interface. The process is straightforward: the lander inputs the requisite transaction particulars, meticulously detailing the exchange, and culminates this step by tapping the "Create" button, thus setting the transaction in motion.

Fig. 5. App Screenshots depicting Transaction Creation

B. Transaction Phase 2: Transaction Agreement

Within this phase, the borrower takes centre stage. Their role involves a meticulous review of the transaction details for accuracy and completeness. Upon satisfaction that all facets align with expectations, the borrower proceeds to formalize their commitment by pressing the "Accept" button within the transaction interface. This decisive action propels the transaction into a "partially committed" state, signifying the collective agreement on its terms and conditions.

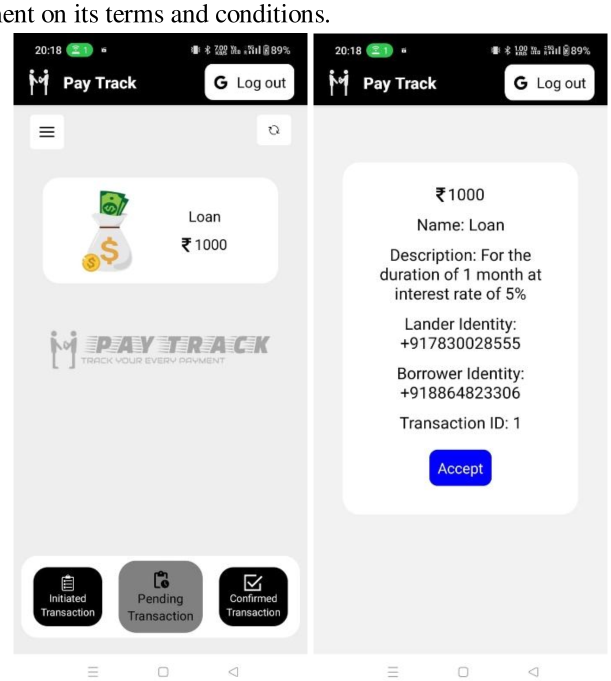

Fig. 6. App Screenshots depicting transaction agreement

C. Transaction Phase 3: Transaction Commitment

The culmination of our transaction journey unfolds in this phase, where the lander finalizes their commitment by submitting photographic proof of the transaction. To achieve this, the lander has a window of 24 hours from the initial transaction to provide the essential evidence. This proof, once successfully submitted, not only signifies the transaction's commitment but also ensures its immutable storage within the blockchain ledger.

To capture this crucial evidence, the application offers a streamlined process. By simply tapping the "Take Picture" button, the device's camera interface is readily invoked, allowing the lander to capture a snapshot of the transaction in real time.

The journey of this captured image continues within the "Check Proof" section, accessible through the designated button. Here, users can meticulously inspect the submitted proof for accuracy and clarity. When fully satisfied, the lander can conclude this phase by tapping the "Submit Proof" button within the "Check Proof" section, thereby etching the transaction into the annals of the blockchain ledger.

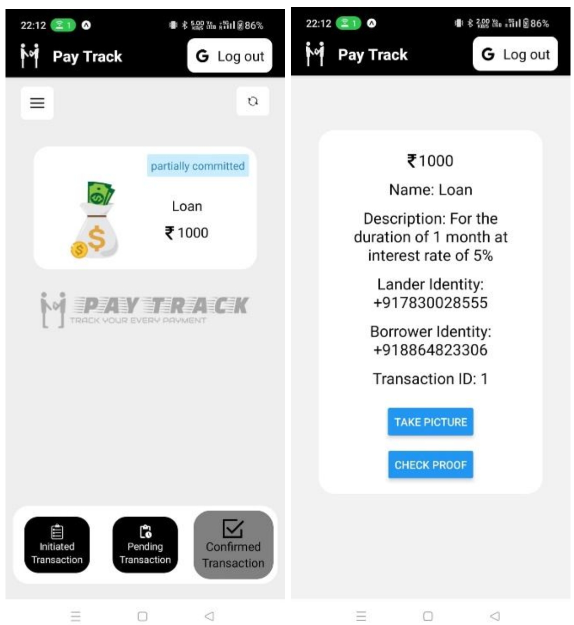

Fig. 7. App Screenshots depicting transaction commit phase

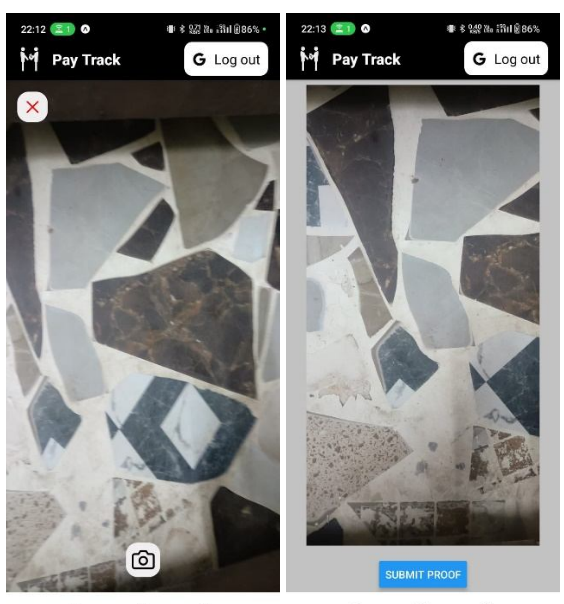

Fig. 8. App Screenshots depicting “Take Picture” and “Check Proof” section

VII. CONCLUSION

The landscape of secure transactions is continually evolving, and our research has ventured into uncharted territory by addressing the critical need for securing physical transactions through the innovative application of blockchain technology. As we conclude this study, several key findings and insights emerge, reshaping our understanding of transaction security and offering a promising path forward.

A. A Novel Transaction Model

We introduced a novel transaction model that thrives on mutual agreement between transaction participants, a meticulous record-keeping process, and the undeniable security benefits of blockchain technology. This model not only enhances transaction security but also ensures an unalterable, transparent record of every exchange, bridging the gap between physical and digital transactions.

B. The Role of Blockchain

Our exploration into blockchain's pivotal role in securing transaction records shed light on the technology's inherent attributes, including transparency, immutability, and decentralized security. These attributes, when harnessed effectively, contribute to safeguarding transaction records with unprecedented reliability and trust.

C. Practical Implementation

The development of our Android application using React Native, complemented by an Express-powered server and MySQL database, served as a tangible manifestation of our research. The practicality and usability of this application underscored the feasibility of our transaction model in real-world scenarios.

D. Challenges and Future Directions

Throughout this research, we encountered challenges, including scalability and energy consumption concerns associated with blockchain technology. These challenges, while formidable, represent opportunities for further exploration and refinement. We envision future research endeavors delving into mitigating these obstacles to ensure the scalability and sustainability of blockchain-based transaction security.

E. A New Era of Secure Physical Transactions

In closing, our research represents a significant step toward ushering in a new era of secure physical transactions. By combining blockchain's strengths with innovative transaction models, we lay the groundwork for a safer, more transparent exchange of physical goods and services. Our work not only fills a research gap but also paves the way for practical applications that can transform the transaction landscape.

As the digital and physical worlds continue to converge, the importance of secure, verifiable physical transactions becomes increasingly evident. Through our research, we strive to make this vision a reality, fostering trust, accountability, and integrity in the transactions that shape our daily lives.

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