

Reputation Management on Blockchain

Harihara Vinayakaram¹[0000-0002-9434-7528], Prateek Yammanuru²[0000-0003-2934-2760] and
Meher Akshay³[0000-0001-6416-5208]

^{1,2,3} Wipro Technologies, Bangalore, India

harihara.natarajan@wipro.com

Abstract. There is a large population in the world who are unbanked. Some of the main reasons for this is that the unbanked population do not have enough money or they do not see any use of having a bank account. As these people do not have bank accounts there is no way to check the credit worthiness and as cost of giving loans are high for banks, they do not generally get loans for lesser amounts from banks. In this paper, we propose a system to create a digital footprint for these unbanked people, provide micro loans to them and use blockchain to do this to reduce the costs for the banks to provide loans.

Keywords: Banking, Micro loans, Digital footprint.

1 Introduction

About 2 billion people [1] are unbanked throughout the world and India is one of the major countries with a large unbanked population of around 19% [2]. There are a lot of reasons for the population being unbanked, among which the major reasons being that either they do not have enough money at a given time (i.e.) a cash flow problem or they do not see any use of having a bank account. The general benefit of having creditworthiness due to a bank account does not apply in these cases because the credit that these people want is generally low and banks do not find it viable to give loan of lesser amounts due to the high costs involved. A typical customer profile that we are choosing is “Imagine Rajni to be a street vendor. Every day she borrows Rs.90 from a money-lender, buys vegetables and sells them at a mark-up. She makes about Rs.130-140, and pays back Rs.100 to the lender. She pays a usurious interest rate because the cost of servicing small loans is high—more importantly, because she has no other option. A new moneylender is likely to trust her even less and the rates would be just as high “. Because of this a large informal market of small loans of typically less than 1000 for small periods of less than a week is prevalent, but the interest rates for these informal loans are exorbitant. The scenarios might vary locally (e.g.) weavers might borrow 3,000 Rs a week to complete a saree and then get paid by the master weaver etc. According to World Bank [3], financial services are not yet affordable or designed to fit low income users. So, we propose a system which is designed to make providing loan affordable for banks and attract low income users who take small loans from local money lenders into the banking system and thus create a digital footprint with which

they can get higher loans based on the repayment history. The reputation system and microloans in this model helps in bringing customers into the banking system and provides a reason for further using the banking services thus benefitting banks as well as customers.

2 Related Work

The current credit score system prevalent in India is not transparent and user does not have much control over who can and cannot use their credit score information. This credit score system does not work for people who generally do transactions in small amounts and take loans informally from local money lenders as banks do not provide loans for such small amounts.

There are a host of Micro Payment solutions that are present

- Micro ATM used by banks: These systems do not address the loans but provide other banking facilities like withdrawal
- NBFC Micro loans: addressed by NBFC companies like MicroGraam. These do not use the banking system and provide a P2P like model. The model trusts the verifiers and there is no transparency. These are also not shared and thus have a high chance of defaults.
- Self-help Groups (SHG): These are funded by the government but require financial discipline and thrift. They achieve the objective of modeling and incentivizing financial behavior change but require a lot of commitment.
- SME and MSME lending: This is a huge sector for funding especially with the advent of GST which facilitates a lot of verification and validation. But this does not address the segment of unbanked population.

The financial inclusion and the digital foot prints for rural citizens in China took a different path and was fueled by the ecommerce industry. The success of the scheme can be gauged by the “war of red envelopes” [4] in which users - both individuals and businesses – could post links to the digital “red envelope” either on their news feed or in group chats. Those who click the link get a small cash coupon that can be applied on services like online shopping or paying for taxi.

3 Model & Discussion

We are targeting the ambitious rural person who would want to succeed and currently does not have any moorings when they move to an unknown environment (e.g.) to a bigger town / city where they are not known to any person. We are proposing a model in which the reputation and the digital footprint of the user is maintained by a block-chain and the access can be finely adjusted by the user by sending transactions to the smart contracts on Blockchain. The key drivers of the model are

1. The shopkeeper has physical cash in his shop which can be lent to the user.

2. The users (borrowers, lenders) and the shopkeeper need tools which will help them fulfill their aspirations.
3. There is an inherent desire from a large part of the population as seen from the success of the P2P model world-wide. This model helps banks to institutionalize P2P funding and use the unbanked cash by raising their reputation
4. Consent based architecture which allows easy checking of the reputation by sending an SMS
5. Blockchain is ideally suited for a reputation management system [5] as the reputations can be calculated continuously rather than in discrete intervals. This ensures that all stake holders are incentivized to keep their reputation recent and does not suffer from one-off events

The identity of the user can be known from the Aadhar authentication API. As this model proposes short term loans mainly for small business purposes, it is being assumed that the user has a SMS enabled mobile phone and the merchant has a smart phone, thus making it easy for wider population to use this model. This system also assumes that the user has a bank account because of which it might not directly help the unbanked, but it provides an incentive for the unbanked population to join banking system as it provides a formal line of credit at low interest rates. There is also a 2-factor authentication with the registered mobile number to ensure that the user is taking the loans and also that merchant does not replay the same loan requests again and Aadhar authentication request id is also stored in the smart contracts for future reference and to prevent duplicates.

The funds that are needed for providing the loan are created by the bank by letting their customers invest in a fund for a fixed amount of time during which the fund is used for providing loans and collecting back those loans with some interest. So, the funds are also crowdsourced and the eligibility of providing loans is maintained by the smart contracts which encode the rules for providing loans from that fund.

Fig. 1. Sequence Diagram for Onboarding User

The onboarding of user is done by the merchant as shown in Fig. 1, where the internal flows are also depicted. A user contract is created on successful registration of the user and along with that, a bank account contract and reputation contract are also created for the user. User contract helps in controlling the access to user contract details and to check if user permitted an entity to access/interact with user data. Bank account contract acts as a contract where the transaction done as part of this system are maintained and any updates necessary are sent to the core banking system. Reputation contract maintains the reputation and the interactions due to which that reputation was calculated which provides transparency to the user. The requirements for registering with this model will be a bank account, Aadhar number and SMS enabled mobile. Once registered the user is authenticated with a private key, mobile and Aadhar.

Once the user is onboarded onto the system they can take loans and withdraw money from bank account. The user will also get a digital footprint which can be used by anyone to whom the user has given access to. The sequence diagram for the getting a loan is depicted in Fig. 2. The user must provide the Aadhar number authentication using fingerprint, private key and registered mobile to get a loan. The limit for this loan is calculated based on reputation gained by the user in the system. When the

Fig. 2. Sequence diagram for user getting a micro loan

loan request is received and after validation with the reputation scores, a loan contract is created by taking the funds from a fund contract and then the loan amount is sent to the shopkeeper so that the loan amount is paid to user as cash. The sequence diagram for user repaying the loan and the process behind it is represented in Fig. **Error! Reference source not found.**3. The user can repay the loan by specifying the loan amount, Aadhar number using which the loan is taken. The loan contract self-destructs on repayment of loan and the funds received by the shopkeeper from the user are paid back to the fund as repayment of the loan. Then the reputation of both user and the shopkeeper are updated accounting for the repayment of the loan which helps in getting a higher loan the next time due to the digital footprint. Because this system maintains the reputation of the customer, it can be used even when moved to other part of the country. So, this reputation system can be used to introduce loans of small amounts into the formal banking system thus helping bank and customer to easily access higher loans.

This model has benefits other than the digital footprint of the customer because the shopkeeper can be used to withdraw money instead of ATM which need continuous maintenance by the bank, and the money circulation in the village is also increased as the shopkeeper is also acting as an ATM.

Implementation of this model will involve banks to be part of a blockchain platform and as this data should be shared only to allowed parties, the blockchain should be a private blockchain.

The current work involves creating minimal viable product for this model on multiple platforms like Quorum, Hyperledger Fabric, Multichain and Stellar but currently we are looking at Quorum as a platform to build this model.

Fig. 3. Sequence diagram for user repaying a micro loan

4 Challenges

There are a lot of challenges in making this model more user friendly and easy to adopt. One of the challenge is how to remove the requirement of private key to be stored by the user which is given during registration. One more challenge is the scenario in which user losses the private key, for which we are looking at a Multi-Sig approach in which the user nominates some people who will be involved when the private key should be

regenerated to solve the problem of user losing the private key. Few more challenges are how to handle scenarios when user who took loan defaults on repaying the loan, who will bear the cost and how to model such that user is held responsible for such behavior, how to prevent shopkeeper from refusing to provide loans and other benefits of the system, how to allow other members of the family to take loan on behalf of the user and how to handle scenarios when the SMS is not reaching the customers in the process of getting loan. We have been looking at creating a reputation model which considers the negative behaviors like defaulting on the loan, shop refusing service and so on. A challenge with the implementation of this model involves the modelling of the interactions between contracts by preserving the privacy of user data on Blockchain.

5 Conclusion

This model can be used to maintain digital footprint for people who generally transact in small amounts thus helping wider population to access loans and also helping the banks in bringing more people into the banking system.

This model can also be extended in future to address the employment verification history in the non-formal sector, if the users are willing to share their financial history.

References

1. World Bank Global Findex, <http://www.worldbank.org/en/programs/globalfindex>, last accessed 2017/11/19
2. Assocham-EY Study, <http://www.assocham.org/newsdetail.php?id=6397>, last accessed 2017/11/19
3. World Bank, <http://www.worldbank.org/en/topic/financialinclusion/overview>, last accessed 2017/12/06
4. Forbes, <https://www.forbes.com/sites/liyanchen/2015/02/19/red-envelope-war-how-alibaba-and-tencent-fight-over-chinese-new-year/>, last accessed 2017/12/08
5. Colony white paper, <https://blog.colony.io/the-colony-whitepaper-502a7b5722b2>