A

Major Project

On

A DECENTRALIZED BASED APPROACH FOR MICROFINANCE USING BLOCKCHAIN TECHNOLOGY

(Submitted in partial fulfillment of the requirements for the award of Degree)

BACHELOR OF TECHNOLOGY

In

COMPUTER SCIENCE AND ENGINEERING

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2019-2023

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

CERTIFICATE

This is to certify that the project entitled **"A DECENTRALIZATION BASED APPROACH MICROFINANCE USING BLOCKCHAIN TECHNOLOGY"** being submitted by **K.SHIVANI (197R1A05E3) , S.SHASHANK (197R1A05G6) & T.V.RAGHURAMSATHWIK (197R1A05H4)** in partial fulfillment of the requirements for the award of the degree of B.Tech in Computer Science and Engineering to the Jawaharlal Nehru Technological University Hyderabad, is a record of bonafide work carried out by them under our guidance and supervision during the year 2022-23.

The results embodied in this thesis have not been submitted to any other University or Institute for the award of any degree or diploma.

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Submitted for viva voice Examination held on _____

ACKNOWLEDGEMENT

Apart from the efforts of us, the success of any project depends largely on the encouragement and guidelines of many others. We take this opportunity to express our gratitude to the people who have been instrumental in the successful completion of this project.

We take this opportunity to express my profound gratitude and deep regard to my guide **K.RANJITH REDDY,** Assistant Professor for his exemplary guidance, monitoring andconstant encouragement throughout the project work. The blessing, help and guidance given by him shall carry us a long way in the journey of life on which we are about to embark.

We also take this opportunity to express a deep sense of gratitude to the Project Review Committee (PRC) **Dr. Punyaban Patel, Ms. Shilpa, Dr.T. Subha Mastan Rao & J. Narasimharao** for their cordial support, valuable information and guidance, whichhelped us in completing this task through various stages.

We are also thankful to **Dr. K. Srujan Raju,** Head, Department of Computer Science and Engineering for providing encouragement and support for completing this project successfully.

We are obliged to **Dr. A. Raji Reddy,** Director for being cooperative throughout the course of this project. We also express our sincere gratitude to Sri. **Ch. Gopal Reddy,** Chairman for providing excellent infrastructure and a nice atmosphere throughout the courseof this project.

The guidance and support received from all the members of **CMR Technical Campus** who contributed to the completion of the project. We are grateful for their constant support and help.

Finally, we would like to take this opportunity to thank our family for their constant encouragement, without which this assignment would not be completed. We sincerely acknowledge and thank all those who gave support directly and indirectly in the completion ofthis project.

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ABSTRACT

Financial inclusion is seen as a dynamic tool for achieving multifaceted microeconomic stability, (and) sustainable economic growth, job creation, poverty reduction, and income equality for both developed and developing nations. The needy segments of the population must be provided with financial services to accomplish this inclusion. Still, the traditional financial market is unavailable due to its lack of collateral and shallow income. Thus, they go to local moneylenders, also known as "loan sharks," who charge exorbitant interest rates. Introduction to microfinance came as a new and refreshing light to these needy segments of the population as it provides small valued loans (micro-credit) to support their micro-scale businesses and engage in productive activities. As emerging technology started to be incorporated into every aspect of society, thus microfinance also needed to be incorporated into the technology. An application is required to protect data integrity and smoothly influence the microfinance sector. As the databases are vulnerable to data manipulation, this can affect the transaction history of the loan. Blockchain technology can be used to solve this problem, as data in the Blockchain is stored immutably. So, we designed a microfinance application that uses blockchain technology with decentralised KYC architecture to reduce multiple KYC verification and easy access to micro-credit.

LIST OF FIGURES/TABLES

LIST OF SCREENSHOTS

TABLE OF CONTENTS

1. INTRODUCTION

1.1 PROJECT SCOPE

This project is titled "A Decentralized KYC based Approach for microfinance using blockchain technology". Politicians and economists have debated how to reduce extreme poverty worldwide for decades. In 2001, 2.7 billion people- more than half of the world's population –lived on less than $2 wage per day, and 1.1 billion on less than $1 wage per day. Rural women in developing nations are the poorest and most vulnerable, much as women in sub-Saharan Africa are the most prone to extreme poverty. According to economists Ross Levine, Asli Demirguc-Kunt , and Thorsten Beck, increased financial development in an underdeveloped country causes the incomes of the poorest citizens of that country to grow more quickly than the average per capita gross domestic product (GDP), which is the nation's output of goods and services divided by its population. As a result, poverty rates drop faster than they otherwise would, and income inequality declines more quickly.

1.2 PROJECT PURPOSE

To promote the financial development of underdeveloped countries, people who require financial assistance should be provided with financial services. But there is a misconnection at the core of banking: banks couldn't lend to people without fixed income or collateral. Hinson cited geographical distance as the primary barrier stopping the poor from using traditional banking services. To tackle this problem, microcredit came up as the solution. Microcredit, also known as micro banking or microfinance, provides credit to unconventional borrowers, such as the underprivileged, typically in the form of small loans with no collateral. It was introduced by Muhammad Yunus, a Nobel Peace Prize economist who implemented a Grameen Bank Network in Bangladesh.

1.3 PROJECT FEATURES

The proposed lending model eliminates middle parties like banks in the loan management process. It decreases the time taken to a great extent. Using Blockchain will ensure that no one will default on their transaction. Lenders can gain more interest rates for their invested money than banks. Borrowers can achieve low-interest rates for the money they borrow compared with banks. The proposed decentralized KYC model eliminates human interaction in the process of KYC verification to a great extent. It restricts the submission of one's documents in multiple organizations, with a high risk of data bleaching if any of those organizations compromise the security systems. There will be only one database to store the documents they will be maintained with high-security standards. As every transaction will be held in Blockchain and are highly resistant to modification, neither of the parties can default any transaction.

2. SYSTEM ANALYSIS

System Analysis is an essential phase in the system development process. The System is studied to the minute details and analyzed. The system analyst plays an important role of an interrogator and dwells deep into the working of the present system. In analysis, a detailed study of these operations performed by the system and their relationships within and outside the system is done. A key question considered here is, “what must be done to solve the problem?” The system is viewed as a whole and the inputs to the system are identified. Once the analysis is completed the analyst has a firm understanding of what is to be done.

2.1 PROBLEM DEFINITION

Even considering a party with high ethics and highly secured databases, it costs those parties a high charge for the KYC verification and maintaining the security of the databases. These charges can burden companies that verify their customers with the KYC verification process. It's not only the companies verifying the documents that are meant for this financial burden. Even government bodies are victims of this financial burden. The government even should spend to secure their databases.

2.2 EXISTING SYSTEM

To promote the financial development of underdeveloped countries, people who require financial assistance should be provided with financial services. But there is a misconnection That banks couldn't lend to people without fixed income or collateral. Hinson cited geographical distance as the primary barrier stopping the poor from using traditional banking services. Microcredit came up as the solution. Microcredit, also known as micro banking or microfinance, provides credit to unconventional borrowers, such as the underprivileged, typically in the form of small loans with no collateral. Grameen Bank gives the loan to the group based on the repayment credibility of the few people from that group who were given loans on the first attempt.

2.2.1 DISADVANTAGES OF EXISTING SYSTEM

- So when authorities started storing data in the database, they couldn't find the data concerning the many loans.
- One reason may be the mismanagement amongst the lenders and borrowers having few mandatory documents.
- And many times, borrowers fail to secure a loan due to a lack of trust due to no proper availability of documentation.
- Additionally, the sector hires representatives who could not be deemed reliable, wasting time and resources.
- Thus, making the loan-granting process time-consuming and untraceable.

2.3 PROPOSED SYSTEM

The proposed lending model eliminates the middle parties like banks in the loan management process. It decreases the time taken to a great extent. Using Blockchain will ensure that no one will default on their transaction. Lenders can gain more interest rates for their invested money than banks. Borrowers can gain low-interest rates for the money borrowed compared with banks.

The proposed decentralized KYC model eliminates human interaction in the process of KYC verification to a great extent. It restricts the submission of one's documents in multiple organizations, with a high risk of data bleaching if any of those organizations compromise the security systems. There will be only one database to store the documents so they will be maintained with high-security standards. As every transaction will be held in Blockchain and are highly resistant to modification, neither of the parties can default any transaction.

2.3.1 ADVANTAGES OF THE PROPOSED SYSTEM

- The microfinance application framework (Micro chain) uses blockchain technology to ensure trust, transparency, privacy, and security, reducing fraudulent activities and increasing productivity in the microfinance industry.
- The microcredit business is crucial in the fight against poverty, especially in underdeveloped nations.
- There is preliminary evidence that blockchain technology can help with social, political, and economic concerns.
- Concerns about trust are a hurdle for NGOs and borrowers in the microcredit system. More works talk about the infusion of technology and microfinance, paving more paths for the upliftment of the underprivileged segment fusion.

2.4 FEASIBILITY STUDY

The system which is compatible with connecting network is more feasible for this project and analyzed in this phase and a very general plan for the project and some cost estimates. The developed system must have a modest requirement, as only minimal or null changes are required for implementing this system.

- Technical Feasibility
- Social Feasibility
- Economic Feasibility

2.4.1 ECONOMIC FEASIBILITY

The developing system must be justified by cost and benefit. Criteria to ensure that effort is concentrated on a project, which will give the best, return at the earliest. One of the factors, which affect the development of a new system, is the cost it would require. The following are some of the important financial questions asked during the preliminary investigation:

- The costs conduct a full system investigation.
- The cost of the hardware and software.
- The benefits in the form of reduced costs or fewer costly errors.

Since the system is developed as part of project work, there is no manual cost to spend for the proposed system. Also, all the resources are already available, which gives an indication that the system is economically possible for development.

2.4.2 TECHNICAL FEASIBILITY

This study is carried out to check the technical feasibility, that is, the technical requirements of the system. Any system developed must not have a high demand for the available technical resources. The developed system must have a modest requirement, as only minimal or null changes are required for implementing this system.

2.4.3 BEHAVIORAL FEASIBILITY

This includes the following questions:

- Is there sufficient support for the users?
- Will the proposed system cause harm?

The project would be beneficial because it satisfies the objectives when developed and installed. All behavioral aspects are considered carefully and conclude that the project is behaviorally feasible

2.4.4 SOCIAL FEASIBILITY

The aspect of the study is to check the level of acceptance of the system by the user. This includes the process of training the user to use the system efficiently.The user must not feel threatened by the system, instead must accept it as a necessity. The level of acceptance by the users solely depends on the methods that are employed to educate the user about the system and to make him familiar with it. His level of confidence must be raised so that he is also able to make some constructive criticism, which is welcomed, as he is the final user of the system.

2.5 HARDWARE & SOFTWARE REQUIREMENTS

2.5.1 HARDWARE REQUIREMENTS:

Hardware interfaces specify the logical characteristics of each interface between the software product and the hardware components of the system. The following are some hardware requirements.

System	:	Intel core i3(Minimum).
Hard Disk	:	1 TB.
Monitor	:	14’ Color Monitor.
Mouse	:	Optical Mouse.
Ram	:	8 GB.

2.5.2 SOFTWARE REQUIREMENTS:

Software Requirements specify the logical characteristics of each interface and software component of the system. The following are some software requirements,

Operating system	: Any Operating System.
Coding Language	: Solidity, JavaScript.
Front-End	: HTML, CSS, JavaScript.
Data-Base	: Blockchain

3. ARCHITECTURE

3.1 PROJECT ARCHITECTURE

This project architecture shows the procedure followed for classification, starting from input to final prediction.

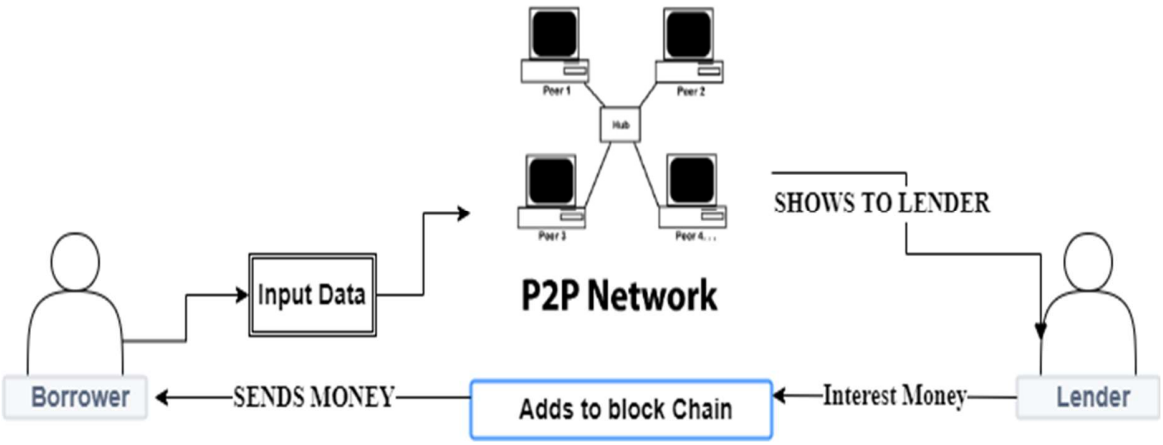

Figure 3.1: Project Architecture of Website of A Decentralized based approach for microfinance

3.2 DESCRIPTION

The main objective of the lending model is to establish a secure peer-to-peer connection between the money lender and borrower and to store the transactional data in the most secure storage platform. The lending model consists of two participants, one is Money Lender, and the other is Money Borrower. There will be a peer-to-peer connection developed between the lender and the borrower.

3.3 USE CASE DIAGRAM

A use case diagram at its simplest is a representation of a user's interaction with the system that shows the relationship between the user and the different use cases in which the user is involved. A use case diagram is used to structure the behavior thing in a model. The use cases are represented by either circles or ellipses.

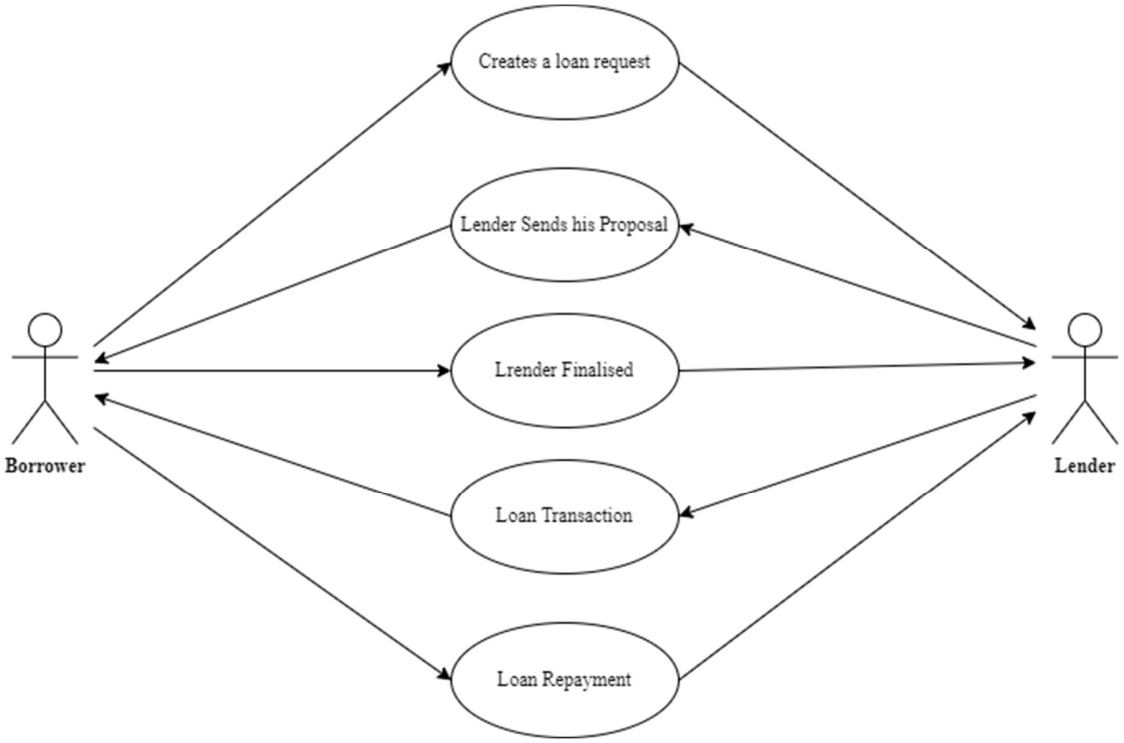

Figure 3.2: Use Case Diagram of Website of A Decentralized based approach for microfinance

3.4 CLASS DIAGRAM

In software engineering, a class diagram in the Unified Modelling Language (UML) is a type of static structure diagram that describes the structure of a system by showing the system's classes, their attributes, operations (or methods), and the relationships among the classes. It explains which class contains information.

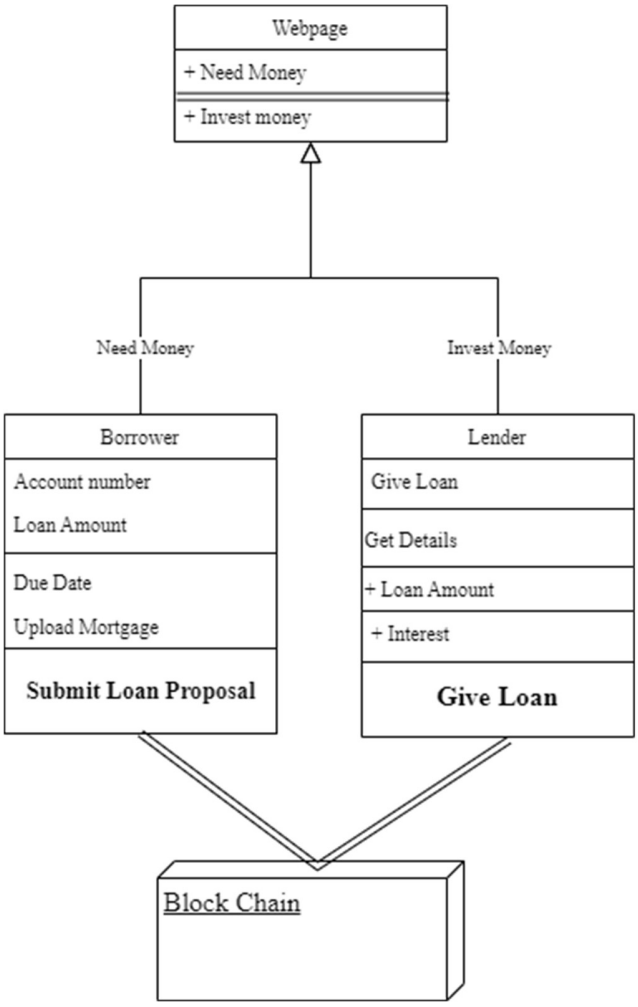

Figure 3.3: Class Diagram of the Decentralized based approach for microfinance.

3.5 SEQUENCE DIAGRAM

A sequence diagram shows object interactions arranged in a time sequence. It depicts the objects involved in the scenario and the sequence of messages exchanged between the objects needed to carry out the functionality of the scenario. Sequence diagrams are typically associated with use case realizations in the logical view of the system under development.

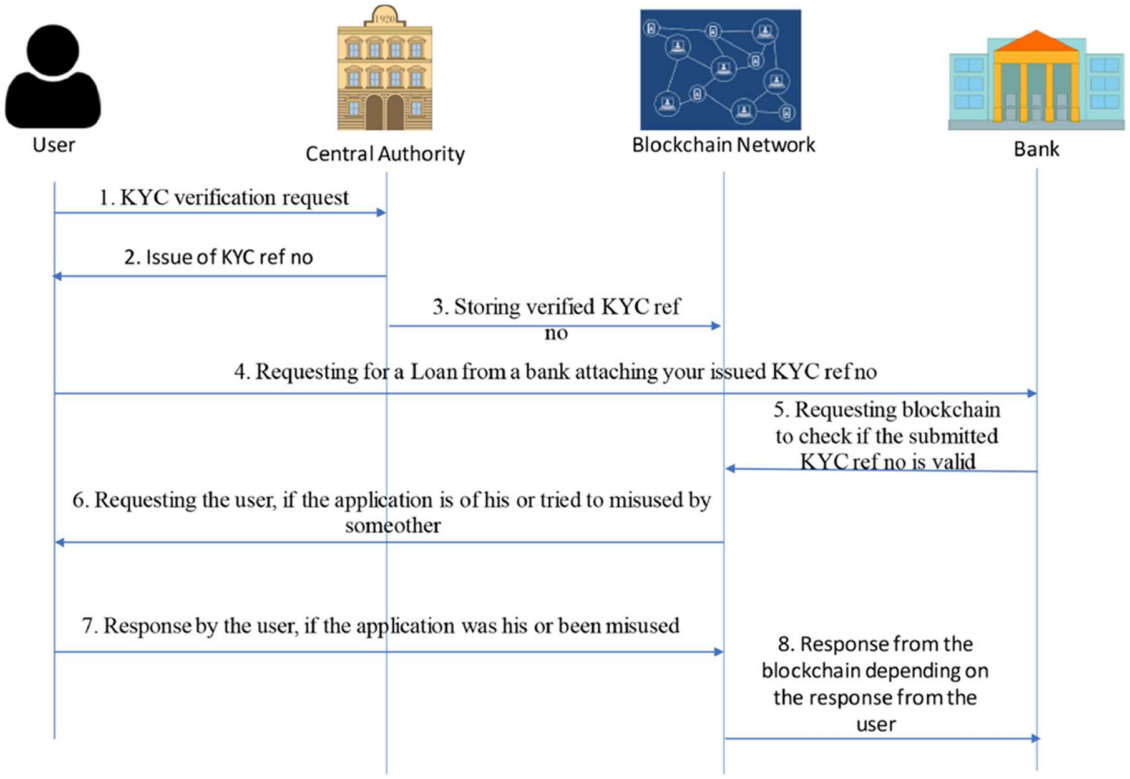

Figure 3.4: Sequence Diagram of The Website of A Decentralized based Approach for Microfinance

3.6 ACTIVITY DIAGRAM

An activity diagram illustrates the dynamic nature of a system by modeling the flow of control from activity to activity. An activity represents an operation on some class in the system that results in a change in the state of the system. Typically, activity diagrams are used to model workflow or business processes and internal operations. Because an activity diagram is a special kind of state chart diagram, it uses some of the same modeling conventions.

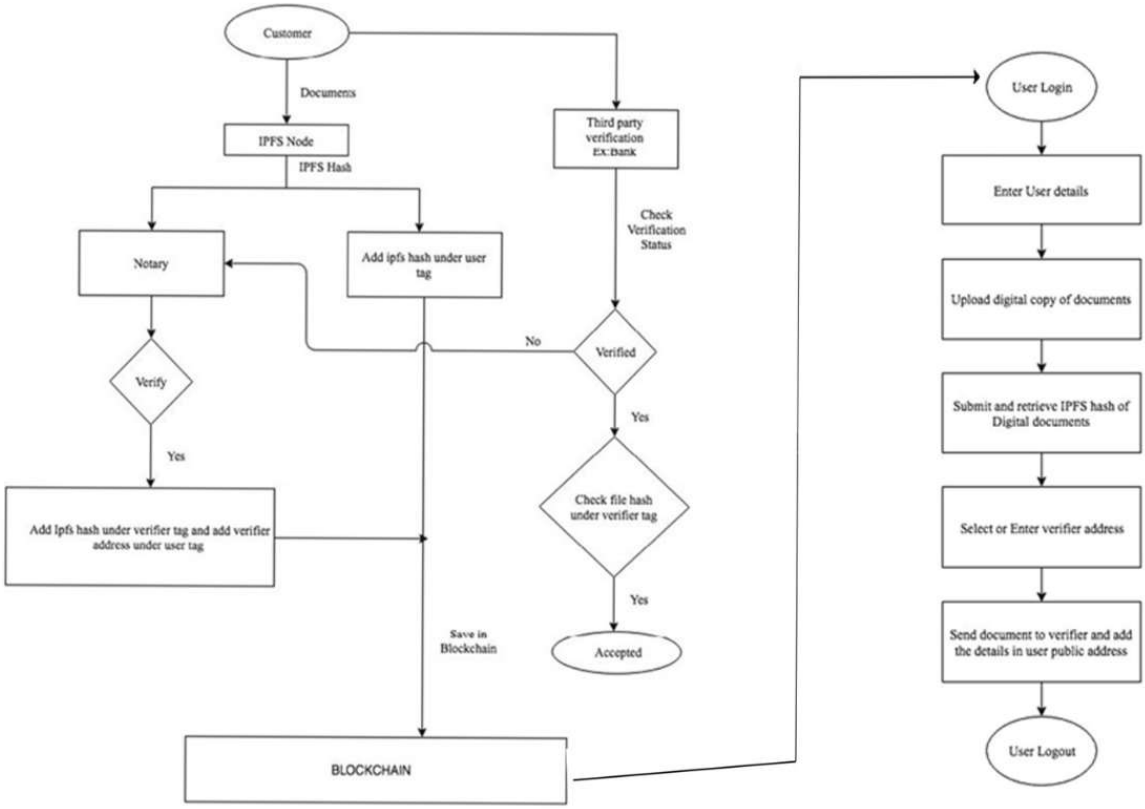

Figure 3.5: Activity Diagram of a Decentralized Based Approach for Microfinance.

4. SAMPLE CODE

```
// SPDX-License-Identifier: MIT
pragma solidity >=0.4.22 <0.9.0;
pragma experimental ABIEncoderV2;

import "./SafeMath.sol";

contract Lending {
    using SafeMath for uint256;
    using SafeMath for uint256;

    enum ProposalState {
        ACCEPTED,
        ACCEPTING,
        WAITING
    }
    enum LoanState {
        REPAID,
        ACCEPTED,
        WAITING,
        PAID,
        FAILED
    }

    // borrower
    struct Proposal {
        uint256 proposalId;
```

```
    address borrower;
    uint256 amount;
    uint256 time;
    string mortgage;
    ProposalState state;
    bool sendMoney;
  }

  struct Loan {
    uint256 loanId;
    address lender;
    uint256 loanAmount;
    uint256 interestRate;
    uint256 proposalId; // not sure?
    uint256 time;
    LoanState state;
  }

  Proposal[] public proposals;
  Loan[] public potential_lenders;
  Loan[] public loans;

  mapping(uint256 => address) public proposalToBorrower;
  mapping(uint256 => address) public loanToLender;

  function createProposal(
    uint256 _loanAmount,
    uint256 _time,
```

```
    string memory _mortgage
) public {
    //change loanAmount to amount?
    uint256 _proposalId = proposals.length;
    proposals.push(
        Proposal(
            _proposalId,
            msg.sender,
            _loanAmount,
            _time,
            _mortgage,
            ProposalState.WAITING,
            false
        )
    );

    proposalToBorrower[_proposalId] = msg.sender;
}

function acceptProposal(
    uint256 _loanAmount,
    uint256 _interestRate,
    uint256 _proposalId
) public {
    uint256 _loanId = potential_lenders.length;
    potential_lenders.push(
        Loan(
            _loanId,
```

```
            msg.sender,
            _loanAmount,
            _interestRate,
            _proposalId,
            block.timestamp,
            LoanState.WAITING
        )
    );
    loanToLender[_loanId] = msg.sender;
    proposals[_proposalId].state = ProposalState.ACCEPTING;
}

function sendETHtoContract() public payable {
    //msg.value is the amount of wei that the msg.sender sent with this transaction.
    //If the transaction doesn't fail, then the contract now has this ETH.
}

function getAllPotentialLenders() public view returns (Loan[] memory) {
    return potential_lenders;
}

function getAllProposals() public view returns (Proposal[] memory) {
    return proposals;
}

function getAllLoans() public view returns (Loan[] memory) {
    return loans;
}
```

```
function acceptLender(uint256 _loanId, uint256 _proposalId) public {
    loans.push(
        Loan(
            _loanId,
            loanToLender[_loanId],
            potential_lenders[_loanId].loanAmount,
            potential_lenders[_loanId].interestRate,
            _proposalId,
            block.timestamp,
            LoanState.PAID
        )
    );

    proposals[_proposalId].state = ProposalState.ACCEPTED;

    potential_lenders[_loanId].state = LoanState.PAID;

    proposals[_proposalId].sendMoney = true;

    // (bool success, ) = msg.sender.call.value(
    //     potential_lenders[_loanId].loanAmount
    // )("");
    // require(success, "Transfer failed.");
}

// function repayAmount(uint256 _loanId) public view returns (uint256) {
//     if (loans[_loanId].state == LoanState.ACCEPTED) {
```

```
    //         uint256 startTime = loans[_loanId].time;
    //         uint256 finalAmount = 0;
    //         uint256 principalValue = loans[_loanId].loanAmount;
    //         uint256 paymentTime = block.timestamp;
    //         uint256 interestRate = loans[_loanId].interestRate;
    //         uint256 loanTime = paymentTime - startTime;

    //         uint256 interest = (
    //             principalValue.mul(interestRate).mul(loanTime)
    //         ) / (365 * 24 * 60 * 60 * 100);

    //         finalAmount.add(interest);
    //         finalAmount.add(principalValue);

    //         return finalAmount;
    //     }
    // }

    function loanPaid(uint256 _loanId) public {
        potential_lenders[_loanId].state = LoanState.REPAID;
    }
}
```

5. SCREENSHOTS

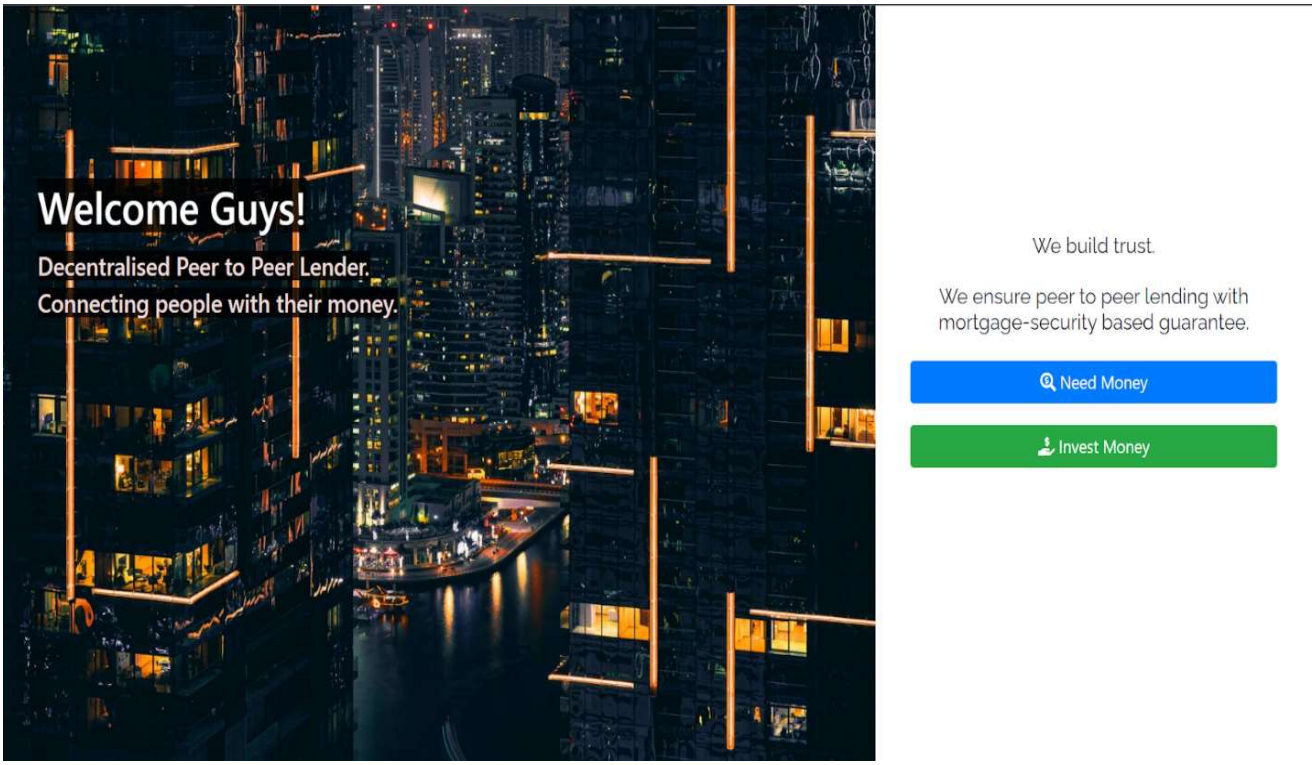

Fig 5.1: Home Page For the Decentralized Web Application

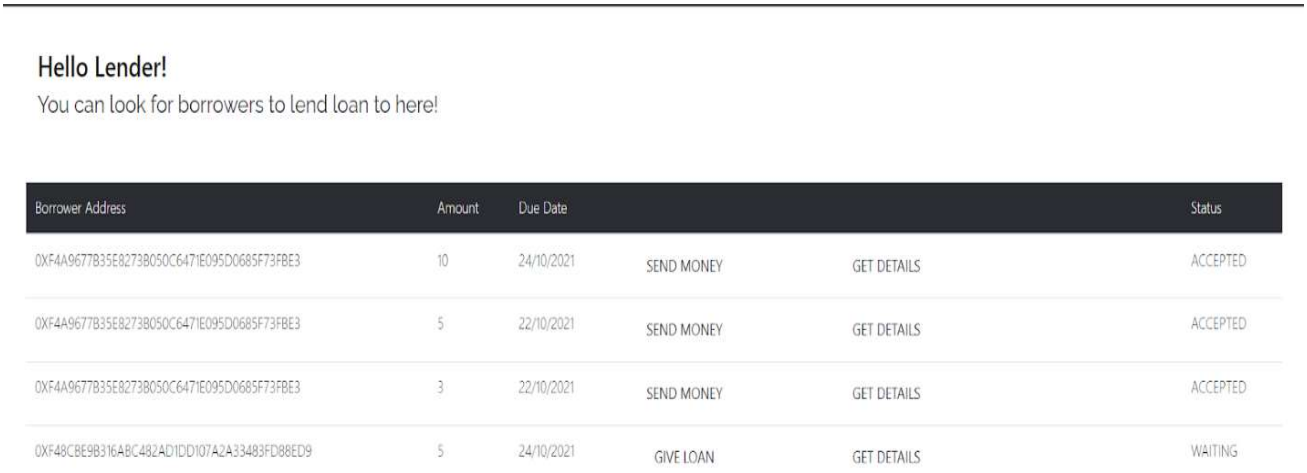

Fig 5.2 : Lender's Page From the View of Borrowers Request

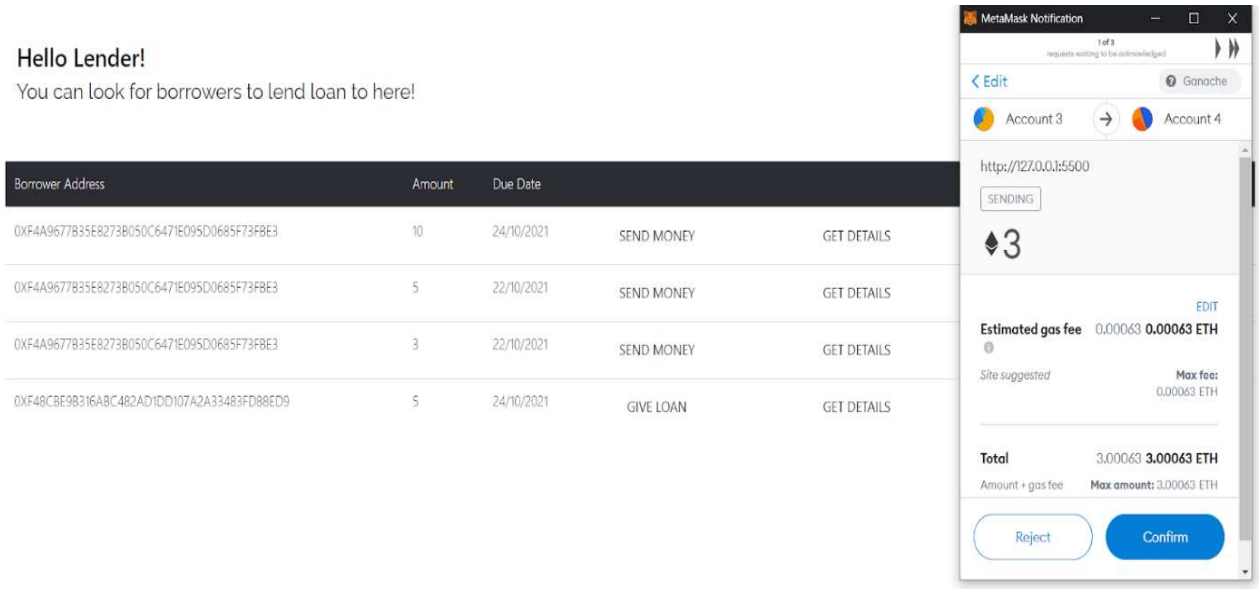

Fig 5.3: Metamask Notification from Chrome Extension to the lender

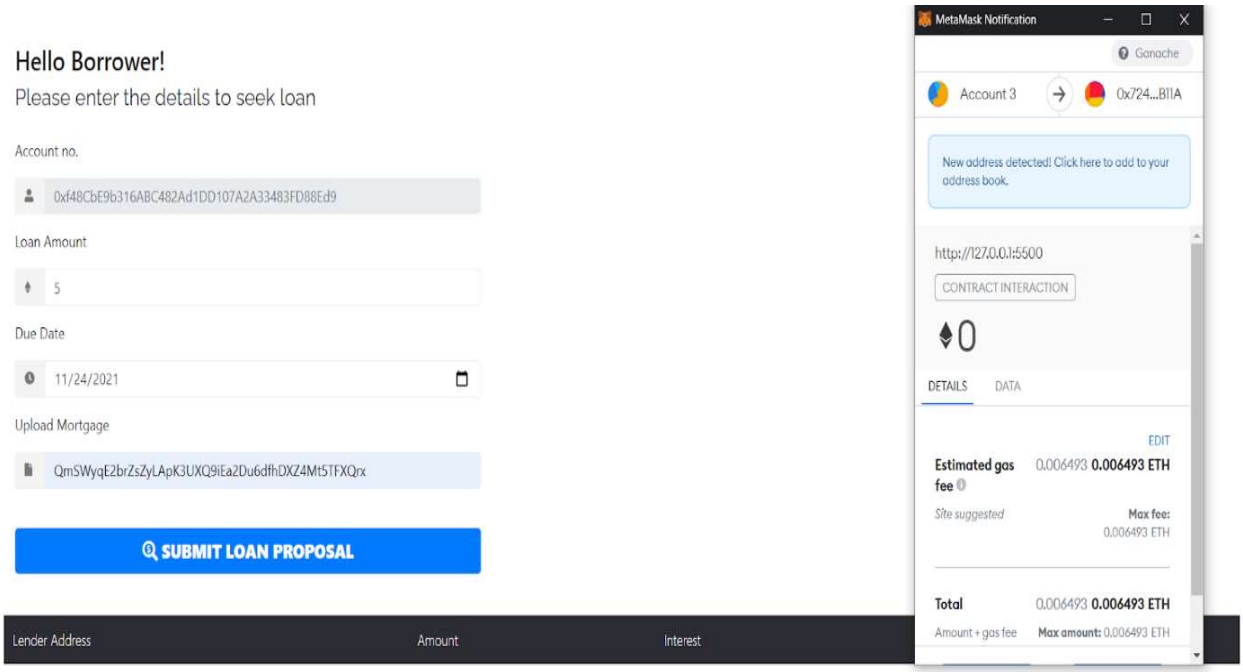

Fig 5.4: Borrower's Page to Request Loan connected to Metamask

Fig 5.5: Lender's view of the Borrower's Verification Details

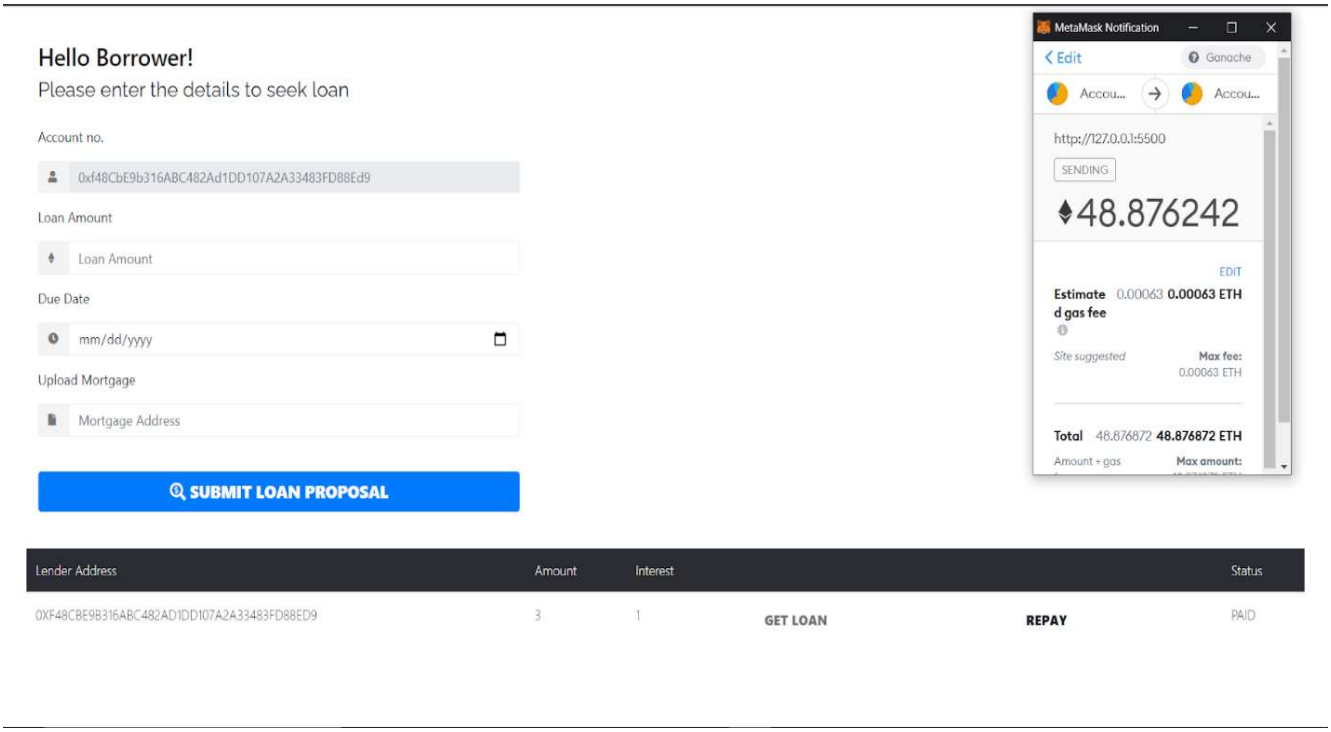

Fig 5.6: The Chrome Extension Showing the Metamask as The Borrower Receiving ETH.

6. TESTING

6.1 INTRODUCTION TO TESTING

The purpose of testing is to discover errors. Testing is the process of trying to discover every conceivable fault or weakness in a work product. It provides a way to check the functionality of components, subassemblies, assemblies and/or a finished product. It is the process of exercising software with the intent of ensuring that the Software system meets its requirements and user expectations and does not fail in an unacceptable manner. There are various types of tests. Each test type addresses a specific testing requirement.

6.2 TYPES OF TESTING

6.2.1 UNIT TESTING

Unit testing involves the design of test cases that validate that the internal program logic is functioning properly, and that program inputs produce valid outputs. All decision branches and internal code flow should be validated. It is the testing of individual software units of the application. It is done after the completion of an individual unit before integration. This is a structural testing that relies on knowledge of its construction and is invasive. Unit tests perform basic tests at component level and test a specific business process, application and/or system configuration. Unit testsensure that each unique path of a business process performs accurately to the documented specifications and contains clearly defined inputs and expected results.

6.2.2 INTEGRATING TESTING

Integration tests are designed to test integrated software components to determine if they actually run as one program. Integration tests demonstrate that although the components were individually satisfactory, as shown by successfully unit testing, the combination of components is correct and consistent. Integration testing is specifically aimed at exposing the problems that arise from the combination of components.

6.2.3 FUNCTIONAL TESTING

Functional tests provide systematic demonstrations that functions tested are available as specified by the business and technical requirements, system documentation, and user manuals.

Functional testing is centered on the following items:

Valid Input : identified classes of valid input mustbe accepted.

InvalidInput: identified classes of invalid input mustbe rejected.

Functions : identified functions must be exercised.

Output : identified classes of application outputsmust be exercised.

Systems/Procedures:interfacing systems or procedures must be invoked. Organization and preparation of functional tests is focused on requirements, key functions, or special test cases.

6.3 TEST CASES

Test caseID	Test case name	Purpose	Input	Output
1	Invest Money	Lending Money	The user is given the input in the form of a borrowers request page	Output is in the form of the Metamask Chrome Extension
2	Verify User	To Verify the Borrower	The lender receives the Request Notification	Output is verifying the Borrower's Request
3	Need Money	To Request Money	The Borrower Request's The Money	The Request is Visible to the Lender
4	Fill The Details from Borrower side	To Seek Loan	Fill The Required Details	Submit Loan Proposal
5	Transfering Ethers in Metamask	Sending Loan	Metamask is Opened in Extension	The Ethers are Transferred

7. CONCLUSION AND FUTURE SCOPE

7.1 CONCLUSION

We presented a strategy that allows borrowers to obtain instant microcredit from lenders directly, bypassing middle parties. These transactions are carried out on the blockchain network, which records each transaction. Hence, microfinance is implemented using blockchain technology. To reduce the gas price of each transaction, we converted Ethereum blockchain into a polygon blockchain. In polygon blockchain, the gas prices are comparatively significantly less. We also proposed a blockchain approach for KYC verification. This approach enables us to have only one trusted authority where we can complete our KYC verification and use the same KYC whenever a new account is created and KYC verification is required. This allows us not to submit government documents to banks during KYC verification. As part of future work, we would like to make the proposed KYC model decentralized, where we eliminate the involvement of databases, which will help decrease human interaction to a great extent.

7.2 FUTURE SCOPE

The blockchain technology is applicable in different domains ranging from health sector and supply chain management system. This technology is applicable to handling the various challenges that are faced by the traditional system; for example, the functionality of the system depends on the trusted third party, as well as many more. The smart contract system creates an environment of trust as the information and logic of the smart contracts are visible to all the participants of the network (based on the permissioned and permissionless network model).

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8.2 GITHUB LINK:

https://github.com/Raghuramsathwik/A-Decentralized-P2P-Microfinance-in-Blockchain

ISSN 2321 3361 © 2023 IJESC

Research Article Volume 13 Issue No.4

A Decentralized Based Approach for Microfinance Using Blockchain Technology

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Abstract:
Financial inclusion is seen as a dynamic tool for achieving multifaceted microeconomic stability, (and) sustainable economic growth, job creation, poverty reduction, and income equality for both developed and developing nations. The needy segments of the population must be provided with financial services to accomplish this inclusion. Still, the traditional financial market is unavailable due to its lack of collateral and shallow income. Thus ,they go to local moneylenders, also known as "loan sharks," who charge exorbitant interest rates. Introduction to microfinance came as a new and refreshing light to these needy segments of the population as it provides small valued loans (micro-credit) to support their micro-scale businesses and engage in productive activities. As emerging technology started to be incorporated into every aspect of society, thus microfinance also needed to be incorporated into the technology. An application is required to protect data integrity and smoothly influence the microfinance sector. As the databases are vulnerable to data manipulation, this can affect the transaction history of the loan. Blockchain technology can be used to solve this problem, as data in the Blockchain is stored immutably. So, we designed a microfinance application that uses blockchain technology with decentralized KYC architecture to reduce multiple KYC verification and easy access to micro-credit.

Keywords: Blockchain, Transactions, Microfinance, Decentralization

I. INTRODUCTION

Politicians and economists have debated how to reduce extreme poverty worldwide for decades. In 2001, 2.7 billion people-more than half of the world's population –lived on less than $2 wage per day, and 1.1 billion on less than $1 wage per day. Rural women in developing nations are the poorest and most vulnerable, much as women in sub-Saharan Africa are the most prone to extreme poverty. According to economists Ross Levine, Asli Demirguc-Kunt, and Thorsten Beck, increased financial development in an underdeveloped country causes the incomes of the poorest citizens of that country to grow more quickly than the average per capita gross domestic product (GDP), which is the nation's output of goods and services divided by its population. As a result, poverty rates drop faster than they otherwise would, and income inequality declines more quickly.

To promote the financial development of underdeveloped countries, people who require financial assistance should be provided with financial services. But there is a misconnection at the core of banking: banks couldn't lend to people without fixed income or collateral. The geographical distance was cited by Hinson as the primary barrier stopping the poor from using traditional banking services. To tackle this problem, microcredit came up as the solution. Microcredit, also known as micro banking or microfinance, provides credit to unconventional borrowers, such as the underprivileged, typically in the form of small loans with no collateral. It was introduced by Muhammad Yunus, a Nobel Peace Prize economist who implemented a Grameen Bank Network in Bangladesh.

Grameen Bank gives the loan to the group based on the repayment credibility of the few people from that group who were given loans on the first attempt. Over the next two decades, a significant number of organisations from all over the world entered the market to create a successful strategy for generating employment, expanding enterprises, and enhancing a beneficiary's productive potential. Loans taken through MFIs (Microfinance Institutions) in Bangladesh have helped smoothen household consumption. SHGs (Self-help Groups) are one of the core values based on microfinance development and their beneficial impact on society. Worldwide adoption of digital technologies is accelerating, penetrating every aspect of daily life. For people, corporations, and the government's Digital advancements are opening up new avenues of communication, extending opportunities, and boosting productivity. The global microfinance industry is quickly catching up with technological improvements in the financial sector.

So, when authorities started storing data in the database, they couldn't find the data concerning the many loans. One reason may be the mismanagement amongst the lenders and borrowers having few mandatory documents. And many times, borrowers fail to secure a loan due to a lack of trust due to no proper availability of documentation. Additionally, the sector hires representatives who could not be deemed reliable, wasting time and resources. Thus, making the loan-granting process time-consuming and untraceable. Blockchain technology has been taken as an approach to solving this problem. In addition to cryptocurrencies, Blockchain is successfully employed in the financial, identity, supply chain, certification, etc. Traditional database systems cannot accurately deal with problems due to trust and security vulnerabilities. According to research by Beck et al. Blockchain is a trust-free system that also assures privacy and security. Therefore, a microfinance application framework (Micro chain) is suggested in this study. The framework uses blockchain technology to ensure trust, transparency, privacy, and security, reducing fraudulent activities and increasing productivity in the microfinance industry.

The microcredit business is crucial in the fight against poverty, especially in underdeveloped nations. As per Kateeba, information and communication technology (ICT) use computers, microelectronics, and telecommunications to create, store, and transfer information in images, words, or numbers reliably, swiftly, and affordably. It includes both hardware and software. In this technological age, ICT has fundamentally altered financial institutions. Evangelista notes that ICT and microfinance are particularly complementary due to the information-based nature of the services provided by these organisations. By examining the experiences of MFIs, Fatima et al. highlight the prerequisites for successfully implementing MFS. It also intends to advise future organisations interested in using MFS by outlining the "best practices" to follow. According to a survey data from Uganda and Tanzania by Moshy et al. mobile financial services are now available to more customers previously denied access to financial services as services that can reach rural areas. The critical blockchain applications in underdeveloped nations were resented by NirKshetri. Chinese information and communication technology (ICT)-based online microfinance platforms provide financial services and offer both group and individual financing. Blockchain in the microfinance sectors to ease lending is on an upward trend. Athula et al. have provided a Blockchain-based framework for financially viable microfinance outreach to farmers that would allow microfinance institutions to dynamically adjust the loans they offer in response to the farmer's actions, reducing the farmer's vulnerability to severe debt and enhancing crop cultivation, which would improve farm outputs and income. There is preliminary evidence that blockchain technology can help with social, political, and economic concerns. Concerns about trust are a hurdle for NGOs and borrowers in the microcredit system. More works talk about the infusion of technology and microfinance, paving more paths for the upliftment of the under-privileged segment fusion.

II. PRELIMINARY

1. Blockchain

In 1982 David Chum put forward a protocol similar to Blockchain. Stuart Haber and W. Scott Stornetta, two mathematicians in 1991, wanted to implement a system of non-tamperable document timestamps, which provided further work for the chain. Merkle trees were integrated into the design by Haber, Stornetta and Dave Bayer in 1992.In 2008 Satoshi Nakamoto released a white paper describing the first decentralized Blockchain. It was later implemented in the same year.

A distributed database or ledger shared by computer network nodes is a blockchain. A blockchain functions as a digital database for the storage of data. A blockchain collects data in units called blocks, each of which contains a set of data. When a block is filled, it is contained and connected to the block before it, forming the data chain known as the Blockchain. Blocks have predefined storage capacities. After that first block is uploaded, each new piece of information is merged into a new block, which is then added to the chain. It is one of the key differences between a typical database (which usually stores the data in tables) and a Blockchain. When the blocks get filled up, it gets the precise timestamp and is added to the chain, thus providing the exact order of events and adding a layer of transparency. Every block contains its hash, the previous block's hash and its timestamp. The data in the database has been spread amongst several nodes at different locations, which helps in creating redundancy and maintaining the integrity of stored data. Copy of the chain is present with each node of the blockchain network, which gets updated as soon as new blocks get added. There are current blockchain explorers, allowing anyone to see the live transaction made on Blockchain. These properties of Blockchain make transactions on Blockchain more trustful.

For altering the data, the majority of the network needed to consent to that because if a shady character does some changes in one copy get singled out as it does not match everyone's copy while cross referencing. For example, suppose a malicious miner who manages a node on the blockchain network desires to change a certain transaction in the Blockchain. In that case, the miner has to dominate and change more than half of the total copies of the Blockchain to make their new copy agreed upon by the chain. It requires a massive number of resources, and due to the growing size of the ever-increasing blockchain network, it is a difficult task. Thus, in this way, transactions on Blockchain remain immutable. As Blockchain started integrating with many industries, finance may be the sector that gains the most from incorporating Blockchain into its corporate operations. As banks take time to update the changes, Blockchain will precisely give fast output, and it not only helps in the traditional banking sector but also helps in microfinance which will be discussed in the later sections.

2. Smart contracts

In the early 1990s, Nick Szabo proposed the smart contract by referring to it as "a set of promises, specified in digital form, including protocols within which the parties perform on these promises". A smart contract is a decentralized programme which carries out business logic in reaction to the occurrence. Developers design smart contracts by incorporating the terms and conditions for the various events required by the application. An exchange of money, the delivery of services, the release of digitally restricted content, or other types of data manipulation, such as changing the name on a land title, can all benefit from executing a smart contract. Smart contracts can also enforce privacy protection, for example, by allowing the selective release of data that is privacy-protected to comply with a specific request. Different designs exist for how smart contract programme are created, distributed, managed, and updated. They can be kept as a part of a blockchain or other distributed ledger technology and used in various payment systems and digital exchanges, including those that accept Ethereum and other cryptocurrencies. Despite their name, smart contracts are not legally binding agreements. Their primary responsibility is to carry out business logic programmatically, coded into them to perform particular tasks, processes, or transactions in response to a specific set of criteria. Legal action must be taken to link its execution to legally binding agreements between parties.

3. Identities in blockchain

Blockchain provides a permanently unalterable identity called Self-sovereign identity. The self-sovereign identity is more secure than the traditional identity Systems. The users can use the self-sovereign ID to verify their identity, eliminating the need for passwords. This self-sovereign identity is developed from the objective that every individual must have control over

the administration of their identity. This identity allows the users to control their identities, access information and update the same. It enables users to choose the information they prefer to keep private. Users have access to delete their identities if necessary. Through this solution, users will have control over their data rather than giving power to industry giants. Generally, every organisation or platform has a separate authentication process. But, with Self sovereign identity, we can verify our identity in any organisation through one single authentication. This identity eliminates the need for bureaucratic processes to verify identity.

III. PROPOSED SYSTEM

The proposed lending model eliminates the middle parties like banks in the loan management process. It decreases the time taken to a great extent. Using Blockchain will ensure that no one will default on their transaction. Lenders can gain more interest rates for their invested money than banks. Borrowers can gain low-interest rates for the money borrow compared with banks.The decentralized KYC model eliminates human interaction in the process of KYC verification to a great extent. It restricts the submission of one's documents in multiple organizations, with a high risk of data bleaching if any of those organizations compromise the security systems. There will be only one database to store the documents so they will be maintained with high-security standards. As every transaction will be held in Blockchain and are highly resistant to modification, neither of the parties can default any transaction.

IV. PROJECT MODEL WITH BLOCKCHAIN

We proposed a KYC model describing user documents' safe A decentralized approach for microfinance using blockchain technology would involve creating a peer-to-peer lending platform where borrowers and lenders can interact with each other directly, without the need for intermediaries such as banks or microfinance institutions.

The architecture for such a platform would involve the following components:

Blockchain network: The platform would be built on a blockchain network, which would allow for secure, transparent, and immutable recording of all transactions and interactions between borrowers and lenders.

Smart contracts: Smart contracts would be used to automate the lending process, including loan disbursement, repayment, and interest calculations. These smart contracts would be executed automatically, based on pre-defined conditions agreed upon by the borrowers and lenders.

User interface: The platform would have a user-friendly interface, allowing borrowers and lenders to interact with each other easily. Borrowers would be able to submit loan applications, while lenders would be able to browse through loan requests and choose which ones to fund.

Digital wallets: Each user would have a digital wallet, which would store their funds and allow for seamless and secure transactions on the platform.

Credit scoring: To ensure that borrowers are creditworthy, the platform could use a credit scoring system based on their past repayment history and other factors. This would help lenders make informed decisions when choosing which loans to fund.

Governance: The platform would need to have a governance model in place to ensure that it operates fairly and transparently. This could involve a decentralized decision-making process, where platform users have a say in how the platform is managed and operated.

Overall, a decentralized approach for microfinance using blockchain technology has the potential to significantly reduce the cost and complexity of the lending process, while also increasing access to finance for underserved communities.

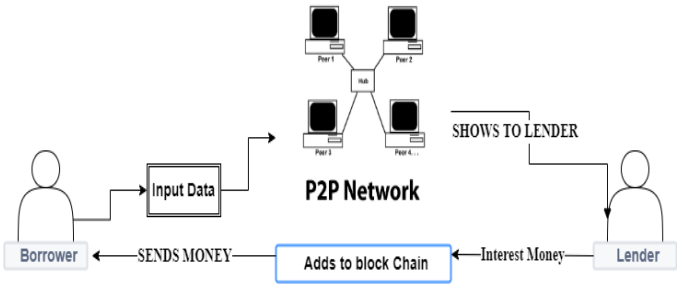

Fig.1: Project Architecture

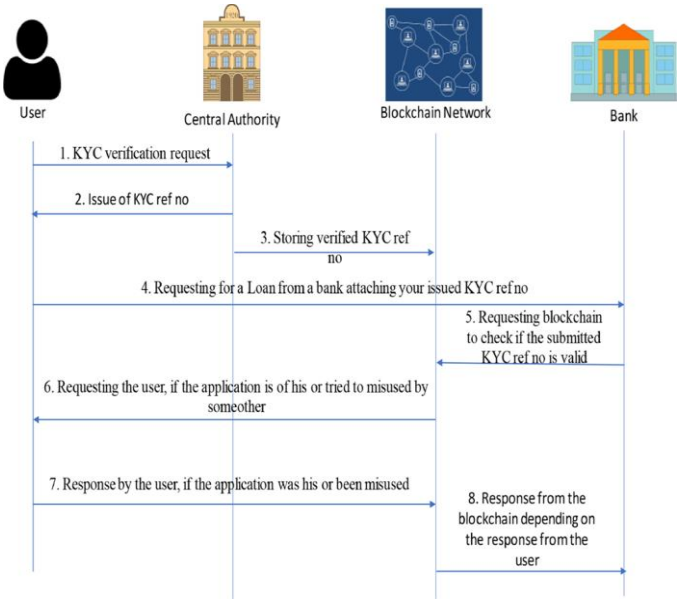

Fig.2: Flow of proposed system

V. CONCLUSION AND FUTURE WORK

Microfinance is a type of banking provided to unemployed or low income individuals or groups that would otherwise be unable to obtain financial services. Microfinance enables people to take out acceptable small business loans safely and in accordance with ethical lending principles. Beyond cryptocurrencies, blockchain technology has proven its disruptive potential and is finding uses across industries. There are numerous use cases for Blockchain and smart contracts in the financial sector. Blockchain-based transactions have attracted the attention of several solution providers due to their promising characteristics of low cost, high speed, transparency, and security, which have prompted them to develop Blockchain-based payment solutions.
So, we presented a strategy that allows borrowers to obtain instant microcredit from lenders directly, bypassing middle parties. These transactions are carried out on the blockchain

network, which records each transaction. Hence, microfinance is implemented using blockchain technology. To reduce the gas price of each transaction, we converted Ethereum blockchain into a polygon blockchain. In polygon blockchain, The gas prices are comparatively significantly less. We also proposed a blockchain approach for KYC verification. This approach enables us to have only one trusted authority where we can complete our KYC verification and use the same KYC whenever a new account is created and KYC verification is required. This allows us not to submit government documents to banks during KYC verification. As part of future work, we would like to make the proposed KYC model decentralized, where we eliminate the involvement of databases, which will help decrease human interaction to a great extent.

ACKNOWLEDGEMENT

We thank CMR Technical Campus for supporting this paper titled "A decentralized KYC based approach for microfinance using blockchain technology", which provided good facilities and support to accomplish our work. Sincerely thank our Chairman, Director, Deans, Head Of the Department, Department Of Computer Science and Engineering, Guide and Teaching and Non- Teaching faculty members for giving valuable suggestions and guidance in every aspect of our work

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IJESC
INTERNATIONAL JOURNAL OF ENGINEERING SCIENCE AND COMPUTING
ISSN 2250-1371
www.ijesc.org

Certificate of Publication

Awarded to

Kandakatla Shivani

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For publishing Research Article in International Journal of Engineering Science and Computing (IJESC)

Volume 13 Issue No 04, April 2023

Manuscript titled

"A Decentralized Based Approach for Microfinance Using Blockchain Technology"

Dr. Aneesh Thomas
Editorial Head, IJESC

IJESC
INTERNATIONAL JOURNAL OF ENGINEERING SCIENCE AND COMPUTING
ISSN 2250-1371
www.ijesc.org

Certificate of Publication

Awarded to

Shashank Samala

(B.Tech Student, Department of Computer Science and Engineering, CMR Technical Campus, Medchal, Hyderabad, Telangana, India)

For publishing Research Article in International Journal of Engineering Science and Computing (IJESC)

Volume 13 Issue No 04, April 2023

Manuscript titled

"A Decentralized Based Approach for Microfinance Using Blockchain Technology"

Dr. Aneesh Thomas
Editorial Head, IJESC

IJESC
INTERNATIONAL JOURNAL OF ENGINEERING SCIENCE AND COMPUTING
ISSN 2250-1371
www.ijesc.org

Certificate of Publication

Awarded to

Tummalapalli Venkata Raghuramsathwik

(B.Tech Student, Department of Computer Science and Engineering, CMR Technical Campus, Medchal, Hyderabad, Telangana, India)

For publishing Research Article in International Journal of Engineering Science and Computing (IJESC)

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