LEVERAGING NFT'S FOR SECURED DECENTRALIZED LENDING

A DEFI SOLUTION

***Abstract* — In the ongoing evolution of blockchain technology and digital assets, non-fungible tokens (NFTs) have become the latest development. Particularly valuable are digital assets, which stand for many types of ownership of physical or digital goods. Because NFTs are unique, they can't be traded for other cryptocurrencies like Bitcoin or Ethereum. Every NFT has a single, indivisible value. Along with opening up a market for new financial services, NFTs are generating new opportunities for producers, collectors, and artists .The proposed work aims to revolutionize secure decentralized lending in the DeFi space by utilizing NFTs generated on digital arts. This creative approach ensures confidence and security in financial transactions by eliminating the need for middlemen. The plan calls for the safe and transparent storage of critical data via blockchain technology, along with the automation of borrower-lender interactions through the use of smart contract. With this strategy, borrowers can obtain financing by using assets that are often illiquid, like real estate, artwork, and collectibles. Smart contracts form the core of the system, acting on their own to automatically carry out collateral transfers and lending arrangements under predetermined parameters. The project, which is being developed on the Ethereum blockchain, aims to provide users with a decentralized financial platform that offers a wide range of financial services. The initiative provides a clear, transparent, and highly secure transaction environment by illuminating how NFT lending and borrowing are managed via smart contracts.**

Keywords —NFTs , Decentralized lending,Smart contracts ,Decentralized Finance(DeFi), Collateral

I. Introduction

Blockchain technology has transformed the way non-fungible token (NFT) ownership data is stored in the modern day, allowing each token to have its distinct attributes identified. NFTs' intrinsic immutability, however, gives rise to worries regarding illicit copies and careless trading methods. The protection of NFT property rights within the NFT and blockchain security ecosystem is the subject of this study, which focuses in particular on problems like NFT fraud and copyright. We investigate the security landscape of the NFT ecosystem using a Systematic Literature Review. The results highlight security issues with copyright violations, data theft, and plagiarism that blockchain technology might not be able to entirely resolve. Therefore, in order to protect themselves from the aforementioned problems, NFT traders need to actively reduce these security risks [1].

Owing to its widespread acceptability, blockchain technology has lately been applied in a number of industries [2], and new prospects are still being explored. The experience of developing a decentralized application (DApp) on the Ethereum network is documented in the paper.

The decentralized lending platform, which uses Ethereum as its underlying architecture, builds a strong foundation for transparency and trust. By automating transactions and lowering reliance on middlemen, the Ethereum blockchain's smart contracts improve the lending process's efficiency. The incorporation of NFTs promotes inclusion in the financial ecosystem by enabling the utilization of collateral that was previously illiquid.

The proposed approach makes use of hashing algorithms used in blockchain technology, like MD5 and SHA [3], to guarantee the security and immutability of block contents. The application of smart contracts improves loan transaction automation and transparency.

The main goal is to use blockchain technology to store financial data in a transparent and safe manner. For loan activities to be precisely automated, smart contracts are essential. NFTs serve as collateral for loans that are backed by priceless possessions including antiques, real estate, and artwork.

This effort represents a revolution in the loan sector by offering a secure solution with strong security features, authentication procedures, and real-time data updates. The initiative users in a new era of decentralized finance by streamlining financial inclusion and setting the bar for safe, efficient, and transparent lending procedures inside the blockchain and cryptocurrency space.

The technological aspects of this study are examined, such as the usage of smart contracts, the establishment of strict security measures for user data, and cooperation with outside data sources. With the help of a scalable and secure platform, the initiative seeks to provide an unmatched Decentralized Finance (DeFi) solution that will allow users to engage in transparent, safe, and efficient lending and borrowing in the digital era."

The rest of this paper's arrangement is as follows. Section 2 Literature Review. Section 3 System Design. Section 4 Implementation. Section 5 Results and Findings. Section 6 Discussion. Section 7 References.

II. LITERATURE REVIEW

This section provides a comprehensive examination of existing research and scholarly works relevant to the subject matter. It serves as a foundation for understanding the current state of knowledge and identifying research gaps. By conducting a systematic review of the literature, this study aims to consolidate and analyze the existing body of work related to the topic at hand

Mochram, R. A. A. “et al”,[1] It explores how blockchain safeguards NFT ownership, highlighting uniqueness. Challenges include unauthorized copies, irresponsible trading, copyright infringement, data theft, and plagiarism. While blockchain has advantages, it may not fully resolve these issues. NFT traders play a crucial role in mitigating security concerns and preserving ownership integrity.

R. Taş and Ö. Ö. Tanrıöver ,[2] The study explores constructing a DApp on Ethereum, showcasing blockchain's growing adoption across domains. It emphasizes DApp opportunities, transparency, distribution, and flexibility. The paper acknowledges blockchain's complexity and integration challenges, highlighting the need for specialized expertise. Authors share their Ethereum DApp development experience, offering insights into blockchain-based applications

Khandelwal, Johari, Gaur, Vashisth.,[3] The study focuses on the utilization of hashing algorithms like MD5 and SHA within Blockchain Technology to ensure the security and immutability of block contents. The research delves into the exploitation of Smart Contract features, leading to the development of an innovative system involving Customers, Car Dealers, and Car Manufacturers. The proposed Smart Contract System aims to facilitate seamless financial transactions, ensuring the hassle-free delivery of vehicles upon timely customer payments.

M. Darlin, G. Palaiokrassas, and L. Tassiulas,[4] this highlights the surge of Decentralized Finance (DeFi) on Ethereum, focusing on lending platforms. They categorize activities within regulatory frameworks, introduce an Ethereum address grouping algorithm, and devise a classification algorithm. Findings indicate stablecoins as debt-financed collateral heighten financial stability risks in the DeFi ecosystem.

Kim, H., Kim, H.-S., & Park, Y.-S,[5] It present a groundbreaking approach, merging ERC-721 Non-Fungible Tokens (NFTs) and perpetual contracts in Decentralized Finance (DeFi). They propose "perpetual contract NFTs" as collateral, providing a proof-of-concept smart contract and a practical web application. The study experiments with Uniswap v3 position NFTs, unlocking financial opportunities and advancing the DeFi landscape.

Y. Zhao “et at",[6] The paper explores the blockchain landscape, highlighting decentralized finance (DeFi) as crucial. Emphasis is on oracles' role in integrating real-world data, with a focus on Chainlink and Band Protocol. A comparative analysis assesses their trustworthiness, offering insights into current DeFi oracle status. The paper proposes metrics and techniques for designing trustworthy DeFi oracles, setting the stage for a robust trust architecture in the future

B. Sriman and S. G. Kumar ,[7] The study highlighted Blockchain's transformative impact on finance, particularly within Ethereum, the second-largest cryptocurrency platform in 2021. It addressed DeFi concerns, identifying key characteristics driving decentralized financial exchange growth. The paper discussed Ethereum's adoption for DeFi exchanges, offering implications for secure cryptocurrency exchange applications using the compound protocol.

Wang “et al”,[8] The authors introduce BLOCKEYE, a real-time attack detection system for Ethereum-based DeFi projects, addressing the security vulnerabilities in the growing DeFi space. Emphasizing automatic security analysis and utilizing an off-chain transaction monitor, BLOCKEYE detects threats like quick and profitable transactions. This approach uncovers previously unreported security issues in popular DeFi projects, enhancing the overall security of decentralized financial systems

L. Zhou “et al”,[9] The paper explores automated profitable transactions in DeFi using two methods: DeFiPoser-ARB for arbitrage and DeFiPoser-SMT for complex transactions. DeFiPoser-SMT identified the bZx attack, yielding 0.48 million USD over 69 days. These tools are estimated to generate significant weekly revenues in ETH and USD, impacting blockchain consensus security by surpassing Ethereum's block rewards up to 874 times.

As a whole, the reviewed literature highlights the complex dynamics of blockchain technology, especially when it comes to decentralized finance (DeFi). Examining many facets including NFT security, smart contract creation, decentralized apps, and oracles, the research sheds light on prospects and obstacles in the developing DeFi environment. Important new information is added to the current conversation by exploring collateralization with NFTs, perpetual contracts, and the crucial function of oracles. As demonstrated by the context of blockchain-based lending platforms, security concerns call for creative solutions like real-time attack detection systems. Furthermore, the incorporation of sophisticated algorithms for transactions that yield profits illustrates the level of sophistication needed to operate inside DeFi protocols.

III. System Design

This section outlines the architectural framework, protocol integration, and smart contract implementation strategies, providing a foundation for the development and deployment of robust and secure DApps.

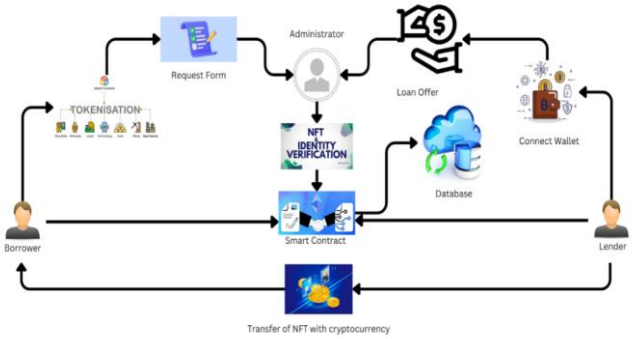

Fig. 1. The Architecture Diagram of the Proposed Approach.

The chosen blockchain infrastructure was Ethereum, primarily due to its robust developer community and widespread use in decentralized finance (DeFi). Despite Ethereum's higher transaction costs and slower transaction times, its extensive DeFi adoption compensates for these drawbacks. This ensures a vibrant ecosystem for the project, fostering innovation and collaboration within the community.

For smart contract development, Solidity is the chosen language owing to its developer-friendly ecosystem and widespread adoption. Smart contracts are integral to the project, serving as digital agreements that automate lending processes and enforce responsibilities, thereby enhancing security and trust in the decentralized environment.

The integration of Chainlink as the oracle platform for secure and reliable price feeds in DeFi applications is a strategic decision. Chainlink's market dominance, wide range of price feeds, and overall data reliability make it a suitable choice for ensuring accurate and timely information within the lending platform.

Incorporating non-fungible tokens (NFTs) as collateral in the lending process adds an innovative dimension to the project. A third-party oracle service is employed to assess the value of NFTs, ensuring efficiency, transparency, and minimizing fraud risk in collateral evaluation.

User authentication and authorization are implemented to ensure secure access to the application. A user-friendly login and registration page contribute to enhancing the platform's overall security features, creating a smooth onboarding experience for users.

The user dashboard is designed with cryptocurrency wallets, active loans, lending offers, and tools for loan management. This user-friendly interface is crafted for both blockchain and DeFi novices, providing a seamless and intuitive experience.

Smart contract automation is a critical aspect of the lending processes, where digital agreements execute automatically when predefined conditions are met. This level of automation enhances security and trustworthiness within the decentralized environment.

Scalability is addressed through the utilization of layer 2 solutions such as side chains or state channels. These measures improve transaction throughput and reduce costs, ensuring the platform remains efficient as it grows. Interoperability is a key design feature, allowing communication with other DeFi protocols and networks like Ethereum. This expands the range of financial services available to users.

Considering regulatory compliance and reliability as crucial factors, the successful execution of the project depends on adherence to relevant regulations. The reliability of the chosen blockchain infrastructure is paramount for the project's execution and overall success.

Looking ahead, future considerations include monitoring the growth of the DeFi community, ensuring seamless interoperability with other protocols, and staying attuned to the overall performance of cryptocurrency markets. These factors will play a crucial role in shaping the ongoing success and evolution of the project

IV. Implementation

The implementation scheme goes by designing two interfaces one for the Nft MarketPlace as shown in Fig.2 and the other for the lending and borrowing as shown in Fig.3. The programming language used for the writing smart contract is Solidity and frontend design using ReactJs. All interactions occur between the frontend and the smart contract deployed in the Etherscan via Api(Infura and Alchemy).Nft are stored in the Pinata it is simple to upload content to IPFS with developer tools and fetch it at blazing speeds with Dedicated Gateways.

Interface :

NFT Marketplace Interface : At the core of the system is the NFT marketplace interface(Fig.2). This serves as the primary gateway for users to explore, transact, and manage their NFT assets. Users can seamlessly browse, buy, sell, and monitor the status of their NFTs through this interface

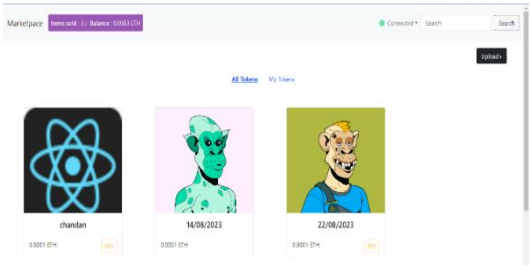

Fig. 2. NFT Marketplace Interface.

A. Lending and Borrowing Interface : Adjacent to the NFT marketplace, the lending and borrowing interface(Fig.3) plays a pivotal role in enabling users to engage in lending and borrowing activities. Users can submit lending and borrowing requests, set terms, and review the status of their active transactions within this interface.

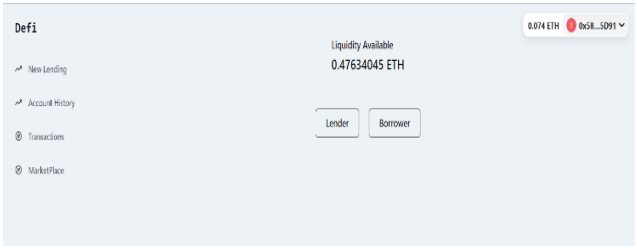

Fig. 3. Lending and Borrowing Interface.

The Functioning :
Main aim to is to merge the vibrant and creative world of NFTs with decentralized finance by providing a marketplace for NFT transactions and a lending/borrowing platform to leverage NFT assets as collateral or for temporary use, expanding the utility and accessibility of NFTs within the broader financial landscape.

Listing and Discovery : Users have the ability to create (as shown in Fig.4) listings for their NFTs, making them available for sale within the platform.The platform provides search and filtering options to help users discover NFTs that match their interests.Detailed information about each NFT, including descriptions and provenance, is often included to aid in the decision-making process.

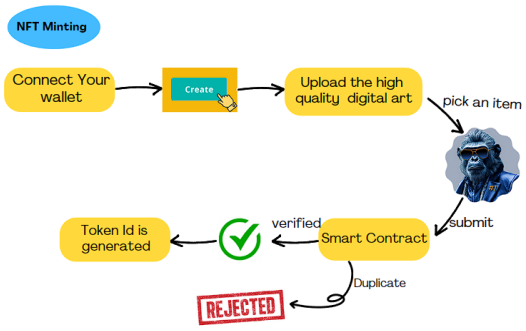

Fig.4 NFT minting Flow diagram

Buying and Selling : Users can purchase NFTs using cryptocurrency,platform provides a secure and seamless transaction experience.Sellers can list back there NFTs in the marketplace.Upon a successful sale, ownership of the NFT is transferred to the buyer, and the seller receives the agreed-upon payment, often in cryptocurrency

Algorithm – 1 : Buy NFT
Require : buyer, tokenId, price

1: if NFT with tokenId exists and is listed for sale then
2: seller ← getOwner(tokenId) ▷ Retrieve current owner of the NFT
3: if buyer has sufficient funds then
4: transferFunds(buyer, seller, price)
5: transferOwnership(buyer, tokenId)
6: removeFromSale(tokenId) ▷ Remove the NFT from the marketplace
7: return "NFT purchased successfully"
8: else
9: return "Error: Insufficient funds"
10: end if
11: else
12: return "Error: NFT not available for purchase"
13: end if

Lender Function :
The lender is the one who deposits money into the lending pool for a predetermined period of time in order to earn interest.We have redeem interest functionality, which allows the interest amount to accumulate and be withdrawn as needed (as stated in the algorithm 3) Fig. 5 illustrates how the Lender implementation works, while Algorithm 2 provides a detailed implementation of the same.

Algorithm- 2: LendMoney
Require : lender, lendingPool, loanAmount, interestRate, loanTerm

1: if lender has sufficient funds to Deposit then
2: createLending(lendingPool,lender, loanAmount,interestRate,Duration)
3: transferFunds(lendeaddressr, lendingPool, Amount) ▷ Transfer loanAmount from lender to the lending pool
4: return "Deposited successfully"
5: else
return "Error: Insufficient funds"
6: end if

Algorithm- 3: Redeem Interest

```
function redeemLendersInterest(uint _lenderId) external payable nonReentrant {
    // Check if the message sender is the assigned lender
    require(msg.sender == lenders[_lenderId].lender, "You must be the assigned lender");

    // Check if the lending fund has matured
    require((lenders[_lenderId].durationInSecs + lenders[_lenderId].startTimeInSecs) >=
    block.timestamp, "This lending fund has matured, please request to receive the funds back");

    // Calculate the number of interest days accumulated
    uint noOfInterestDayAccumulated = (block.timestamp -
    lenders[_lenderId].latestTimeOfInterestRedeemedInSecs) / (24 * 60 * 60);

    // Check if at least 24 hours have passed since the last interest redemption
    require(noOfInterestDayAccumulated >= 1,
    "Interest is earned in 24 hours, please check back later");

    // Calculate the interest earned
    uint interestEarned = lenders[_lenderId].interestEarnedPerDay * noOfInterestDayAccumulated;

    // Update the latest date of interest redeemed
    lenders[_lenderId].latestTimeOfInterestRedeemedInSecs =
    lenders[_lenderId].latestTimeOfInterestRedeemedInSecs + (noOfInterestDayAccumulated * 24 * 60 * 60);

    // Transfer the interest earned to the lender
    (bool success, ) = msg.sender.call{value: interestEarned}("");
    require(success, "Error: Transfer failed.");

    // Emit an event to log the lender's interest redemption
    emit LogLenderInterestRedemption(_lenderId, lenders[_lenderId].lender, interestEarned,
    lenders[_lenderId].latestTimeOfInterestRedeemedInSecs);

    // Emit an event to log the available liquidity
    emit LogLiquidityAvailable(liquidityAvailable);
}
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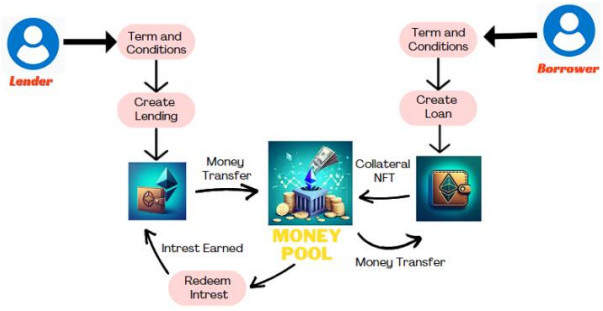

Fig.5 Flow diagram of lender and borrower Function

Borrower Functions:

Borrowers can apply for loans if they have any NFT. They need to provide NFT collateral(as shown in Fig.5).Upon acceptance, a smart contract is initiated. The borrower passes access to the NFT collateral to a smart contract while the loan is active.The Logic is as stated in algorithm 4 .Borrowers make regular interest payments to the lending pool during the loan term, as specified in the smart contract.

Borrowers must repay the borrowed funds within the agreed-upon time frame. Once the loan is repaid in full, the NFT collateral is returned to the borrower

These functions create a bridge between the NFT market (Listing and discovery, Buying and Selling) and decentralized finance (Lending and Borrowing), allowing NFTs to be traded and utilized for loans, expanding their financial utility

Algorithm: BorrowFromPool

Require:borrower,lendingPool,collateral, loanAmount

1:if borrower has sufficient collateral and lendingPool can cover the loanAmount then

2: createLoan(lendingPool, borrower, loanAmount)

- *Create a loan in the lending pool for the borrower*

3: lockCollateral(borrower, collateral)

- *Lock borrower's collateral in the platform*

4: transferFunds(lendingPool, borrower, loanAmount)

- *Transfer loanAmount from the lending pool to the borrower*

5: return "Loan obtained successfully"

6: else

7: return "Error: Insufficient collateral or funds in the lending pool"

8: end if

V. RESULTS

The study's findings underscore the emergence of lending protocols leveraging Non-Fungible Tokens (NFTs) as collateral. Following the protocol's implementation on localhost 127.0.01, React renders the homepage, showcasing functionalities for both lenders and borrowers. It includes wallet integration, account transaction history, and a depiction of new lending opportunities (as illustrated in Fig3).

Additionally, an NFT marketplace is integrated into the platform. Users interested in lending can contribute to the liquidity pool by providing the required tokens based on prevailing market conditions, with fixed interest rates for these tokens. Conversely, borrowers have the option to submit their NFTs as collateral, obtaining loans commensurate with the assessed value of their collateral. These loans come with a specified repayment period.

The protocol offers a variety of use cases that improve Nft holders liquidity while reducing risks via techniques like over-collateralization. These protocols prioritize Nft authentication and appraisal, integrate with NFT marketplaces. Regulatory uncertainty, smart contract weaknesses, and illiquidity are among the challenges that have been noted. Despite its potential for expansion, the market is still in its early stages and presents both opportunities and hazards.

Performance metrics of the protocol:

Total Value Locked (TVL): A pivotal metric gauging the total value of assets, including NFT collateral and tokens, locked within the platform. A growing TVL signifies increased user confidence and adoption as in fig[6].

The below line graph depicts a week observation of total value in the protocol.

y-axis denotes Ethereum price and x-axis denotes days.

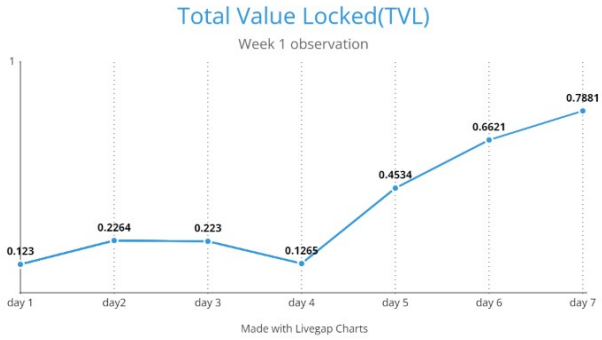

Fig.6.TVL graph

Other metrics such as Active user count signifies popularity and user engagement, offering insights into user behavior trends. Loan volume reflects the borrowed capital, indicating the platform's reliability and utility. Understanding interest rate fluctuations aids in comprehending market demand for borrowing and lending activities.

Monitoring actively traded NFTs on the platform provides insights into the dynamics of the NFT market, particularly regarding price movements and trading volumes of NFTs used as collateral.

The collateralization ratio, comparing collateral value to loan value, determines platform stability and security, higher ratios indicating a more secure environment.

Ensuring smart contract audits and continual security monitoring are essential for user fund safety, contributing significantly to the platform's overall robustness and trust.

These key metrics collectively paint a comprehensive picture of a platform's performance, guiding assessments of its viability and health within the market.

VI. Conclusion

The project introduces innovative applications in decentralized finance with its implementation of an integrated NFT marketplace and a DeFi lending protocol that uses NFTs as collateral. This innovation enables ownership of high-value assets and borrowing against NFTs by providing liquidity to NFT owners without requiring them to give up ownership. the project's meticulously controlled risk through over-collateralization highlights its dedication to strong risk management techniques. Even with these developments, there are still issues, most notably the illiquidity of NFT and regulatory uncertainty.

The combination of DeFi with NFTs is a game-changer for the financial services industry, opening up valuable assets to the general public and changing the face of decentralized finance. Combining these technologies improves risk management procedures while also broadening the applications. Prominent industry participants, like Aave, Compound, and MakerDao, which are mentioned in this project, offer noteworthy features to the current DeFi ecosystem. Although they have a significant impact, Aave's shared liquidity pools and MakerDao ‘s strict usage of stable coins add complexity and weaknesses to smart contracts.

Our DeFi system, on the other hand, is more user-friendly and has a simpler architecture, making it suitable for novice users. The principal feature of the system, which is the use of NFTs as collateral, sets it apart in the DeFi environment and offers a simplified and easily navigable substitute in the rapidly changing decentralized finance market.

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