SYNTHEFI - A DEFI APPLICATION TO OFFER TOKENIZED STOCKS PEGGED TO REAL-WORLD STOCKS

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This Report Presented in Partial Fulfillment of the Requirements for the Degree of Bachelor of Science in Computer Science and Engineering

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APPROVAL

This Project/internship titled **"SyntheFI - A DeFi application to offer tokenized stocks pegged to real-world stocks"**, submitted by **Sadman Sakib**, ID No: 191-15-12481 and **Md Azaz Ahmed**, ID No: 191-15-12546 to the Department of Computer Science and Engineering, Daffodil International University has been accepted as satisfactory for the partial fulfilment of the requirements for the degree of B.Sc. in Computer Science and Engineering and approved as to its style and contents. The presentation has been held on *26/01/23*.

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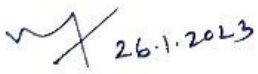

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DECLARATION

We hereby declare that, this project has been done by us under the supervision of **Dr. Sheak Rashed Haider Noori, Professor & Associate Head, Department of CSE** Daffodil International University. We also declare that neither this project nor any part of this project has been submitted elsewhere for award of any degree or diploma.

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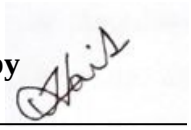

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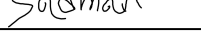

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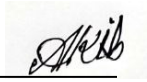

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ABSTRACT

The stock market, particularly the U.S. stock market, can have a high barrier to entry for some individuals. Especially for Non-US citizens. There are also regulatory requirements and fees associated with trading stocks, which can further increase the cost and complexity of entering the market.

Blockchain technology could change how stocks are traded by making the market more open, fraud less likely, and the settlement process more straightforward. By using a decentralized ledger to record transactions, blockchain can provide a secure and immutable record of trades. It can increase confidence in the market and potentially lead to reduced costs for traders. Additionally, smart contracts on a blockchain platform could automate certain aspects of the trading process, further increasing efficiency. Despite these potential benefits, the adoption of blockchain in stock trading has needed to be faster to date, with regulatory and technical challenges remaining. Nevertheless, as technology develops and regulatory frameworks evolve, we will likely see increasing use of blockchain in the stock trading industry in the coming years.

This thesis will examine the potential benefits and challenges of using blockchain in the stock trading industry and the technology's current and potential use cases. This thesis will explore the concept of stock as a synthetic asset and its potential benefits and challenges. It will examine the current state of the market for stock as a synthetic asset and consider the potential for its use in various sectors, including traditional finance and retail investing. The thesis will also consider the regulatory landscape surrounding stock as a synthetic asset and the potential impact of these assets on the broader financial system. Finally, the thesis will examine the technical considerations involved in creating and trading stock as a synthetic asset on a blockchain platform and the potential role of smart contracts in this process.

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CHAPTER 1

Introduction

The U.S. stock market is often viewed as a complex and intimidating place, with a high barrier to entry for many individuals. The cost of purchasing stocks, opening a brokerage account, and the fees and regulatory requirements associated with trading can all be prohibitive for some people. In addition, the perceived risk and unpredictability of the stock market can discourage some individuals from investing.

However, the use of blockchain technology has the potential to lower the barrier to entry for stock trading and make it more accessible to a wider range of investors. By creating synthetic assets, also known as synthetic securities or synthetic tokens, that track the value of a specific stock or a basket of stocks, investors can gain exposure to the stock market without owning the underlying assets. These synthetic assets can be created and traded on a blockchain platform, providing a secure and transparent record of transactions. In addition, using smart contracts on a blockchain platform could automate certain aspects of the trading process, increasing efficiency and reducing the time and cost of settling trades.

This thesis will examine the potential benefits and challenges of using blockchain technology to create and trade synthetic assets in the blockchain. The thesis will also explore the technical considerations involved in creating and trading synthetic assets on a blockchain platform and the potential role of smart contracts in this process. The real objective of this study is to assess the potential of using synthetic assets to lower the barrier to entry for stock trading and make the market more accessible to a wider range of investors around the globe.

This report discusses challenges in four areas: business, backend, frontend, and blockchain. The backend challenges focus on securely storing and retrieving data, including the chosen solution and data structure. The frontend challenges relate to presenting information to the user and implementing interactions with third-party applications. The blockchain

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challenges focus on the functionalities implemented by each smart contract and its deployment.

1.1 The Robinhood and GameStop Saga

“The Robinhood and GameStop scandal of early 2021 was a highly publicized and controversial event that captured the financial world's attention.” [10] At the center of the scandal was the popular stock trading app Robinhood, which was accused of restricting trading in certain stocks, including GameStop, at the height of a price surge. The incident sparked outrage among retail investors and raised questions about the stock market's fairness and the role of Robinhood and other trading platforms in facilitating trades. The scandal also highlighted the influence of social media on stock prices and the potential for market manipulation. The aftermath of the crisis included regulatory investigations and calls for reforms to prevent similar incidents in the future. The Robinhood and GameStop scandal was a significant event that had far-reaching implications for the world of finance. One potential solution to the scandal's issues is using decentralized finance (DeFi) technologies.

DeFi refers to financial services built on blockchain platforms and not controlled by traditional financial institutions. These technologies can increase transparency and fairness in the financial system and reduce the barriers to entry for retail investors. In the wake of the Robinhood and GameStop scandal, there have been calls for the adoption of DeFi solutions as a way to address the issues raised by the incident and promote greater fairness and accessibility in the financial system. DeFi technologies could provide a more transparent and inclusive alternative to traditional financial services, helping to rebuild trust in the financial system in the aftermath of the scandal.

1.2 Project delimitations

The scope of this report is limited to certain delimitations, including the following:

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- **Legal & Contracts:** While it is assumed that a contract verifying system will be implemented in the future, it will not be covered in this report due to the limited capabilities and expertise of the team in this field. It is believed that focusing on this aspect at this stage will not significantly contribute to the prototype and that time would be better invested elsewhere.
- **Helpdesk & FAQ:** As the project is currently in a prototype phase, it is not deemed necessary to include a Helpdesk or FAQ section in the app.
- **Deployment:** The prototype will be run on a local environment but will not be deployed on the cloud. Additionally, the smart contracts will not be deployed on the mainnet as this would require a significant amount of time and money. Instead, they will be deployed on a testnet.

1.3 Research Questions

1. How does SyntheFi's tokenization process differ from other platforms that offer similar services?
2. What are the potential benefits of using SyntheFi to tokenize stocks compared to traditional methods of investing in the stock market?
3. How does SyntheFi ensure the security and integrity of the tokenized stocks on the blockchain?
4. What regulatory considerations must SyntheFi take into account when tokenizing stocks?
5. How does SyntheFi plan to onboard traditional stock investors onto the platform and educate them about the benefits of tokenized stocks?
6. What economic benefits does SyntheFi offer to investors in tokenized stocks compared to traditional stocks?
7. How does SyntheFi plan to handle stock splits, dividends, and other corporate actions in the tokenized stock market?
8. How does SyntheFi plan to handle potential market fluctuations or volatility in the tokenized stock market?

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9. What partnerships or collaborations has SyntheFi established in order to facilitate the tokenization of real world stocks?

10. How does SyntheFi plan to expand its offerings and grow its user base in the future?

1.4 Research objective

The research objective of this project is to develop and deploy a decentralized stock trading application that provides anonymous, worldwide access to traditional stock markets. The goal is to create a trustless ecosystem of decentralized finance (DeFi) applications that make it easy for people in any country to purchase stocks such as Apple and Tesla.

One of the key benefits of this application is its accessibility. By tokenizing stocks, investors can legally access the U.S. stock market and buy and sell U.S. stocks. Additionally, because the shares will be tokenized, buying fractions or portions of a stock will be possible, making it more accessible to a wider range of investors.

Another key advantage of the decentralized stock trading application is that it will be available 24 hours a day, unlike traditional stocks that only trade during certain hours. This will make it easier for people in different time zones to participate in the market. The application will also be accessible everywhere, as anybody with an internet connection can create blockchain-based synthetic assets using an open-source protocol like Synthetix. These synthetic assets can be traded on decentralized blockchain exchanges globally, making it possible for people to participate in the market from anywhere in the world.

In addition to being accessible and available around the clock, the decentralized stock trading application will facilitate borderless synthetic-ass transfers. These assets, such as ERC-20 tokens, can be received and sent from anywhere in the world using standard cryptocurrency wallets. This makes it easier for people to transfer assets between different markets and countries. Finally, the application will provide frictionless trading of synthetic assets, allowing them to be transferred between different asset classes without holding the underlying asset. This will provide much greater liquidity on global exchanges compared to traditional derivatives.

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CHAPTER 2

Literature Review

2.1 Introduction

Blockchain technology is a decentralized digital ledger used to record transactions securely and transparently. It was originally developed as the foundation for the cryptocurrency Bitcoin but has since been applied to a wide range of industries and applications.

“One of the key features of blockchain technology is that it uses cryptography to ensure the security and immutability of recorded transactions. This means that once a transaction is recorded on the blockchain, it cannot be altered or deleted. This makes it an ideal platform for recording and verifying various transactions, including financial transactions, legal agreements, and supply chain records.”[1]

Another important aspect of blockchain technology is that it is decentralized, meaning that a single entity or organization does not control it. Instead, it relies on a network of computers to validate and record transactions, which makes it resistant to fraud and censorship.

There are many potential applications for blockchain technology, including financial services, supply chain management, and the creation of digital assets. As the technology continues to evolve and mature, we will likely see increasing adoption of blockchain in a wide range of industries and applications.

2.2 Basics of blockchain

At a technical level, a blockchain is a data structure that allows for the secure and transparent recording of transactions. It consists of a series of blocks, each of which contains a list of transactions. These blocks are linked together in a chain using cryptographic techniques, which ensures the integrity and security of the data.

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One of the key technical features of blockchain is its decentralized nature, which means that it is not controlled by any single entity or government. Instead, it relies on a network of computers, known as nodes, to validate and record transactions. Each node in the network maintains a copy of the entire blockchain, which helps to ensure that the data is accurate and up-to-date.

In order to add a new block to the chain, a process known as "mining" is used. During mining, nodes in the network compete to solve a complex mathematical problem, and the first node to solve the problem is allowed to add the new block to the chain. This process helps to ensure the security of the network, as it requires a significant amount of computational power to add a new block.

In addition to the decentralized nature of blockchain, another key technical feature is its use of smart contracts. Smart contracts are self-executing contracts with the terms of the agreement between buyer and seller being directly written into lines of code. They allow for the automation of various processes, including the transfer of assets, and can help to reduce the need for intermediaries and increase the efficiency of transactions.

Overall, the technical features of blockchain make it a powerful tool for secure and transparent record-keeping, and have the potential to transform various industries.

2.3 Blocks

In a blockchain, "blocks" refer to the individual units that make up the chain of transactions. Each block contains a list of transactions, as well as some additional information such as a timestamp and a reference to the previous block in the chain.

The transactions contained in a block depend on the type of blockchain being used. In a public blockchain, such as Bitcoin or Ethereum, a block may contain a variety of different types of transactions, including the transfer of cryptocurrency from one user to another, or the execution of a smart contract. In a private blockchain, the types of transactions that are

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allowed may be more limited and specific to the needs of the organization using the blockchain.

The blocks in a blockchain are linked together using cryptographic techniques, which ensures the integrity and security of the data. Each block contains a reference to the previous block in the chain, which creates a permanent and unalterable record of all transactions. This makes it difficult to alter or tamper with the data contained in the blockchain, as any changes to a single block would require the modification of all subsequent blocks in the chain.

2.4 Block time

"Block time" refers to the amount of time it takes for a new block to be added to a blockchain. In other words, it is the interval between the creation of successive blocks in the chain.

The block time for a particular blockchain is determined by the protocol that is used to govern the network. For example, the block time for the Bitcoin blockchain is approximately 10 minutes, while the block time for the Ethereum blockchain is approximately 15 seconds.

The block time for a blockchain is an important factor to consider, as it determines the speed at which transactions can be processed and added to the chain. In general, a shorter block time allows for faster transaction processing, but it also increases the risk of network congestion and may require a larger amount of computational power to maintain the network. On the other hand, a longer block time may result in slower transaction processing, but it may be more energy-efficient and less prone to network congestion.

It's important to note that the block time for a blockchain is not fixed, and it may vary depending on a variety of factors such as the number of transactions being processed, the computational power of the network, and the difficulty of the mining process.

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2.5 The Consensus algorithm

The consensus algorithm is a crucial component of the blockchain system, as it is responsible for ensuring the integrity and security of the data recorded on the blockchain. The consensus algorithm is used to validate and add new blocks to the chain, and it is a key factor in determining the overall performance and reliability of the blockchain.

There are several different types of consensus algorithms that have been developed for use in blockchain systems. The most commonly used algorithms include proof-of-work (PoW), proof-of-stake (PoS), and proof-of-authority (PoA).

In a proof-of-work system, a node has the ability to propose the next block by solving a computationally complex puzzle. The solution to this puzzle can be easily verified by other nodes, allowing them to validate and update the blockchain without difficulty. The node that successfully solves the puzzle is rewarded for their contribution, and this process is known as "mining."

Proof-of-stake is an alternative consensus mechanism that replaces the energy and computational requirements of proof-of-work with a stake. The likelihood of a node becoming the creator of the next block is determined by the amount of stake they are willing to commit for a set period of time. Delegated proof-of-stake (DPoS) is a variant of proof-of-stake in which nodes vote for representatives to conduct the validation on their behalf.

In a proof-of-authority system, the validation of new blocks is performed by a select group of nodes, known as "authorities," who have been chosen for their reputation and trustworthiness.

Overall, the consensus algorithm is a key component of the blockchain system, as it ensures the integrity and security of the data recorded on the chain. The specific algorithm chosen will depend on the needs and goals of the blockchain system, and may be adjusted over time as the needs of the system change.

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2.6 Types of Blockchains

There are several different types of blockchain, each of which has its own unique characteristics and uses. Some common types of blockchain include:

1. **Public blockchains:** These are open, decentralized networks that allow anyone to participate and contribute to the network. Examples include Bitcoin and Ethereum.
2. **Private blockchains:** These are closed, permissioned networks that are controlled by a single entity or group of entities. They may be used for a variety of purposes, including supply chain management and financial transactions.
3. **Consortium blockchains:** These are hybrid networks that are partially open and partially closed. They are typically controlled by a group of organizations, rather than a single entity, and may be used for a variety of purposes, including trade finance and interbank transactions.
4. **Hybrid blockchains:** These are networks that combine elements of both public and private blockchains. They may be used to provide a balance between the transparency and security of public blockchains and the control and privacy of private blockchains.
5. **Sidechain blockchains:** These are separate, independent blockchains that are linked to a main blockchain. They may be used to scale the main blockchain, or to allow for the transfer of assets between different blockchains.

It's important to note that the specific characteristics and uses of a blockchain will depend on the specific design and implementation of the network.

2.7 Smart Contracts

Smart contracts are self-executing contracts with the terms of the agreement between buyer and seller being directly written into lines of code. They are often associated with blockchain technology, as they can be stored and replicated on a blockchain network.

At a technical level, a smart contract is a piece of code that is stored on the blockchain and contains a set of rules and conditions that must be met in order for the contract to be

executed. These rules and conditions can be triggered by external events, such as the receipt of a payment or the expiration of a time period.

One of the key benefits of smart contracts is their ability to automate various processes and remove the need for intermediaries. For example, a smart contract could be used to automatically transfer ownership of an asset from one party to another upon the receipt of payment. This can help to increase the efficiency and speed of transactions, and can reduce the risk of fraud or errors.

Smart contracts are often implemented using a programming language called Solidity, which is specifically designed for use with the Ethereum blockchain. Solidity allows developers to create contracts that can be deployed on the Ethereum network and interact with other contracts or blockchain-based applications.

In order to be executed, a smart contract must be stored on the blockchain and be triggered by an external event. When a trigger event occurs, the contract is executed and the terms of the agreement are automatically enforced. For example, if a smart contract is set up to transfer ownership of an asset upon the receipt of payment, the contract will be executed and the ownership will be transferred automatically once the payment is received.

Overall, smart contracts are a powerful tool that can be used to automate various processes and increase the efficiency and security of transactions. However, it is important to carefully review and test the code of a smart contract before it is deployed on a blockchain network, as any errors or vulnerabilities in the code could potentially lead to issues with the execution of the contract.

2.8 DeFi

Decentralized finance (DeFi) is a financial system that is built on top of blockchain technology and is designed to be open, transparent, and accessible to all. It aims to provide financial services that are decentralized, meaning they are not controlled by a single entity or group of entities.

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“DeFi includes a wide range of financial applications and services, including lending, borrowing, trading, and payment processing. These services are typically provided through decentralized applications (DApps), which are built on top of blockchain networks such as Ethereum.” [2]

One of the key benefits of DeFi is its ability to provide financial services to individuals and organizations that may not have access to traditional financial institutions. This can include people in underbanked or unbanked regions, or those who may not meet the eligibility criteria for traditional financial products and services.

In addition to providing access to financial services, DeFi also aims to increase transparency and security by using blockchain technology to record transactions on a distributed ledger. This helps to reduce the risk of fraud or errors, and can increase the efficiency of financial transactions.

Overall, DeFi is a rapidly growing and evolving field that has the potential to revolutionize the way financial services are provided and accessed. It is still in the early stages of development, and many experts believe that it has the potential to disrupt traditional financial systems and create new opportunities for individuals and organizations around the world.

2.9 Synthetic assets

“Synthetic assets are a type of tokenized derivative in cryptocurrency that represent actual positions or assets. They are similar to other assets, but offer the added benefit of being tokenized, which allows for increased security and traceability.” [3] Derivatives, such as synthetic assets, are popular in the cryptocurrency market because they allow investors to profit from token price fluctuations without actually owning the underlying asset.

Synthetic assets are appealing to traditional traders because they provide a way to invest in a variety of different assets, including stocks, precious metals, and real estate. By tokenizing a real-world asset, an investor receives a token or certificate as proof of

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ownership, which can be traded and transferred on a blockchain network. This allows for increased accessibility and liquidity for both retail and institutional investors.

In addition to providing liquidity and accessibility, synthetic assets also offer security and traceability through the use of blockchain technology. Transactions are recorded on a distributed ledger, which helps to protect the anonymity of traders. As interest in synthetic assets grows, more decentralized finance (DeFi) solutions are emerging to meet the demand.

One of the key advantages of synthetic assets is their ability to provide near-instant liquidity through the use of smart contracts and price oracles. These systems allow for the creation of debt in a variety of assets, with exchange rates being determined by price oracles. Protocols can also provide access to a wide range

Advantages of Synthetic Assets:

Permissionless Minting: With blockchains like Ethereum, anyone can establish a synthetic asset system.

Access and transferability: Synthetic assets can be freely traded and transferred.

Global liquidity: The fact that they have "infinite liquidity" is another benefit of synthetic asset protocols.

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CHAPTER 3

Thesis Background

3.1 History of Stocks

The history of stocks dates back to the late medieval period, when merchants and traders began using formal contracts to represent ownership of a particular asset. These early contracts, known as "stock certificates," represented a share in the ownership of a company or enterprise, and were used to raise capital for business ventures.

“Over time, the concept of stocks evolved, and by the 17th century, public companies were issuing stock certificates to raise capital for business operations. The first publicly traded company was the Dutch East India Company, which was established in 1602 and began issuing stocks to raise capital for its trade ventures.” [4]

In the 18th and 19th centuries, the concept of stocks spread to other countries, and stock markets began to emerge in major cities around the world. The first modern stock exchange was the London Stock Exchange, which was founded in 1773. The New York Stock Exchange (NYSE) was founded in 1792, and today it is one of the largest and most well-known stock exchanges in the world.

Throughout the 20th century, the stock market continued to evolve, and new technologies such as computers and the internet revolutionized the way stocks were bought and sold. Today, stocks are traded electronically on stock exchanges around the world, and they are an important source of capital for businesses and a way for investors to diversify their portfolios and potentially earn a return on their investment.

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3.2 Commission free stocks

Commission-free stock trading refers to the practice of allowing investors to buy and sell stocks without paying a commission or fee to a broker. This type of trading has become increasingly popular in recent years, as a growing number of online brokers have begun offering commission-free trading as a way to attract and retain customers.

The concept of commission-free stock trading can be traced back to the late 1990s, when online brokers such as E*TRADE and Charles Schwab began offering the service. These companies, and others like them, allowed investors to trade stocks online using a computer or mobile device, and they waived the traditional commission fees that had been charged by brokers.

The advent of commission-free stock trading was a major development in the financial industry, as it made stock trading more accessible and affordable for a wider range of investors. Prior to the invention of commission-free trading, investors had to pay a commission for each trade, which could add up to significant amounts over time. Commission-free trading helped to democratize the stock market by making it more accessible and affordable for a wider range of investors.

Today, commission-free stock trading is offered by a number of online brokers, and it has become a popular way for investors to buy and sell stocks. However, it's important to note that while commission-free trading may be attractive to some investors, there are often other costs associated with trading, such as fees for account maintenance or inactivity. Investors should carefully consider all of the costs associated with trading before making any investment decisions.

3.3 Problem with centralized trading

Centralized stock trading refers to the traditional model of buying and selling stocks, in which trades are executed through a centralized exchange, such as the New York Stock

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Exchange (NYSE) or the London Stock Exchange (LSE). There are several problems with centralized stock trading that can impact investors and the overall efficiency of the market:

1. **Lack of transparency:** Centralized exchanges may not provide full transparency about the prices and quantities of stocks being traded, which can make it difficult for investors to make informed decisions.
2. **High fees:** Centralized exchanges often charge high fees for their services, which can eat into the profits of investors.
3. **Limited accessibility:** Some centralized exchanges may only be accessible to certain types of investors, such as accredited investors or institutional investors. This can limit the accessibility of the market to smaller investors.
4. **Market manipulation:** Centralized exchanges may be vulnerable to market manipulation, such as insider trading or price manipulation, which can impact the fairness and efficiency of the market.
5. **Security vulnerabilities**: Centralized exchanges may be vulnerable to cyber attacks, which can lead to the loss of personal or financial information.
6. **Dependence on a single entity:** Centralized exchanges are controlled by a single entity or group of entities, which can create a single point of failure and increase the risk of disruption to the market.

Overall, these problems can impact the efficiency and fairness of the stock market, and can make it more difficult for investors to earn a return on their investments.

3.4 DeFi revolution

Decentralized finance (DeFi) has the potential to revolutionize the way stocks are bought and sold by offering a decentralized alternative to traditional centralized stock trading. DeFi is a financial system built on top of blockchain technology that aims to provide financial services that are open, transparent, and accessible to all.

One of the key benefits of DeFi is its ability to provide increased transparency and security through the use of blockchain technology. Transactions are recorded on a distributed

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ledger, which helps to reduce the risk of fraud or errors and can increase the efficiency of financial transactions.

In addition, DeFi can offer increased accessibility to the stock market, as it is not limited by geography or the requirements of traditional financial institutions. This can make it easier for a wider range of investors, including those in underbanked or unbanked regions, to access and trade stocks.

Overall, DeFi has the potential to revolutionize the way stocks are bought and sold by providing a decentralized alternative to traditional centralized stock trading. It is still in the early stages of development, and many experts believe that it has the potential to disrupt traditional financial systems and create new opportunities for individuals and organizations around the world.

3.5 Challenges

There are several challenges that SyntheFi, a decentralized finance (DeFi) protocol that tokenizes stocks, may face as it continues to develop and gain adoption. Some possible challenges include:

1. **Regulatory hurdles:** Tokenizing stocks and other traditional financial assets may require compliance with a wide range of regulations, depending on the jurisdiction in which SyntheFi is being used. This could be a complex and time-consuming process, and may require the development of new regulatory frameworks.
2. **Competition with traditional financial institutions:** SyntheFi represents a potentially disruptive force in the traditional financial industry, and may face resistance from incumbent players.
3. **Ensuring security and stability:** As with any financial system, ensuring the security and stability of SyntheFi will be critical in order to maintain trust and protect user assets. This could involve implementing robust security measures and responding quickly to any issues that arise.

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4. **Scalability:** As the adoption of SyntheFi grows, it will be important to ensure that the protocol is able to handle a large number of transactions without experiencing delays or other issues.
5. **User experience:** In order for SyntheFi to be successful, it will need to provide a user-friendly experience that is accessible to a wide range of users. This may require significant investment in user experience design and user education.

3.6 Related work

Abra

Abra is the first and only all-in-one worldwide software delivering a genuine crypto exchange and digital wallet – making investing in cryptocurrencies easy. Abra enables users to purchase and store 30 cryptocurrencies and 50 fiat currencies through a single app. Multiple cryptocurrencies and fiat currencies may be exchanged quickly, easily, and securely. In addition, the Abra app enables users to manage all crypto assets on a single screen.

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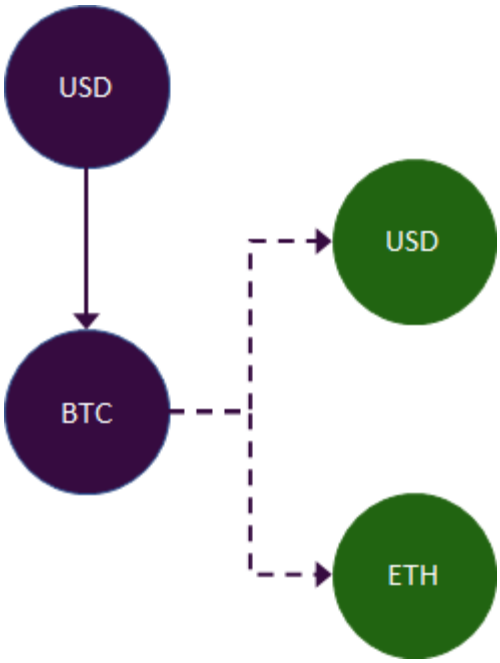

Figure 3.6.1: Purple: Real assets, Green: Synthetic assets

MakerDAo

MakerDAO's definition would be the most logical entrance to begin a discussion on the platform. It is essentially a peer-to-peer or decentralized organization to build technology to support savings, borrowing, and lending functions together with a stable coin on the Ethereum blockchain network. The MakerDAO crypto protocol enables anybody with ETH (Ethereum) and a Metamask wallet to engage in lending and borrowing.

On the site, the user may lend themselves money in the form of the stable cryptocurrency DAI, an intriguing feature. Users are required to lock a particular amount of ETH in the smart contracts of MakerDAO or MKR protocol in order to generate a specified quantity of DAI. For DAI loans, users will essentially be required to post ETH as security.

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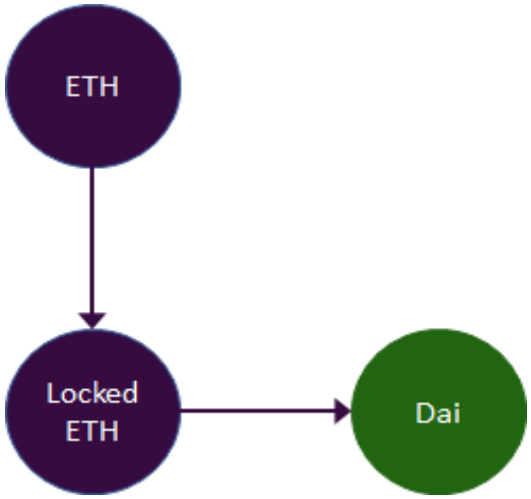

Figure 3.6.2: Purple: Real assets, Green: Synthetic assets

UMA

UMA, which stands for universal market access, is an Ethereum-based technology that enables users to construct collateralized synthetic tokens that can follow the price of nearly anything. In simple terms, UMA enables the trading of any asset using ERC-20 tokens without any exposure to the asset.

This enables anybody to obtain access to items that would otherwise be inaccessible. In addition, the UMA cryptocurrency token is used for protocol governance and its pricing oracle.

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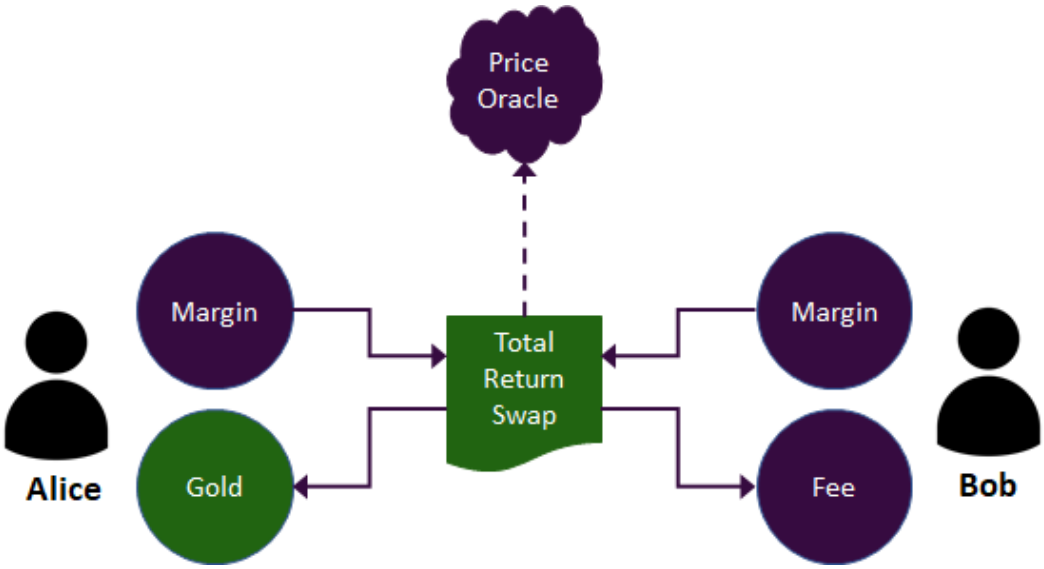

Figure 3.6.3: Purple: Real assets, Green: Synthetic assets

Rainbow Network

The heart of Rainbow's decentralized financial market infrastructure is insurance. The goal is to design an open insurance protocol application using blockchain technology, construct an integrated and interoperable insurance protocol matrix, and establish a unified insurance infrastructure to support the decentralized financial network.

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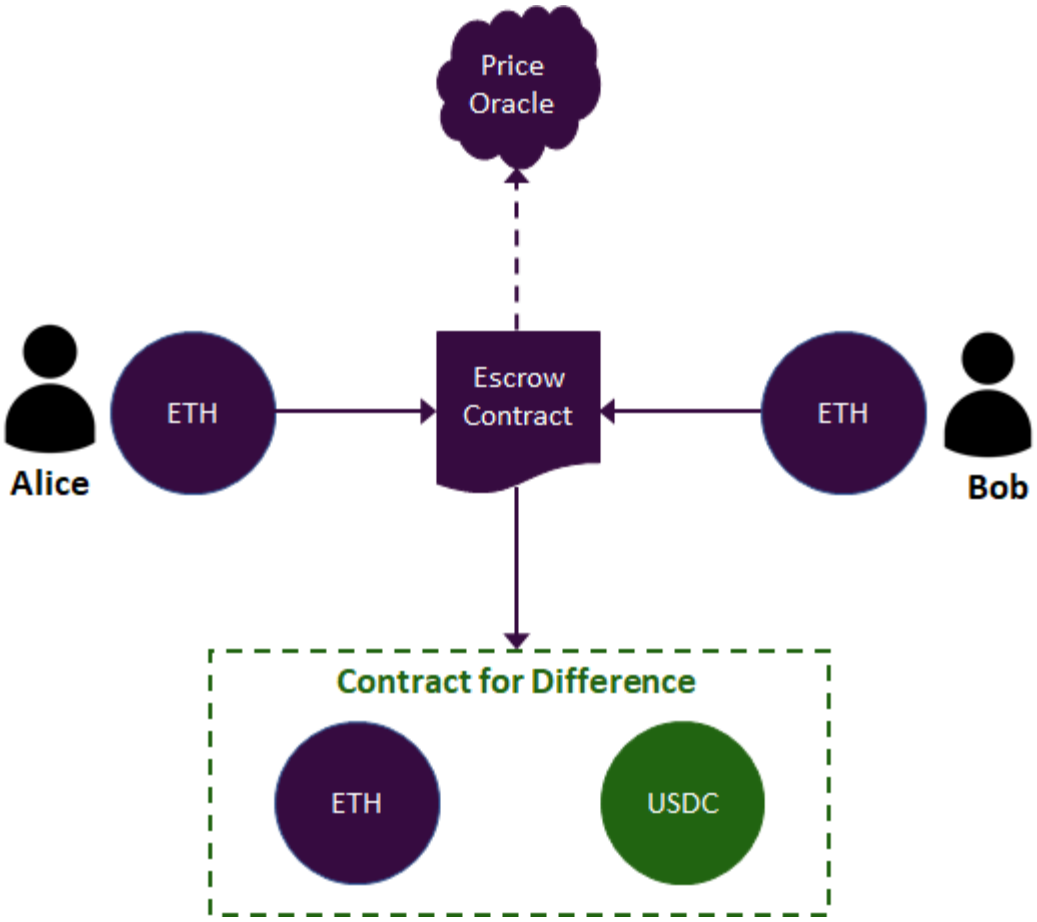

Figure 3.6.4: Purple: Real assets, Green: Synthetic assets

Synthetix

Synths employ decentralized oracles and intelligent contract-based price discovery algorithms to monitor the assets' values, enabling users to keep and trade Synths as if they owned the underlying assets.

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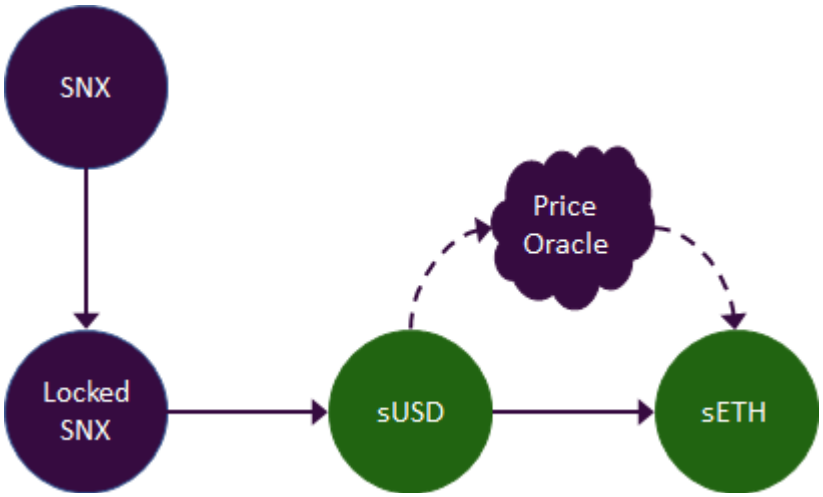

Figure 3.6.5: Purple: Real assets, Green: Synthetic assets

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CHAPTER 4
Research Methodology

4.1 Introduction

SyntheFi is a decentralized application (dApp) that allows users to tokenize stocks and trade them on the blockchain. This revolutionary platform offers global access to stock price exposure to anyone who already has access to cryptocurrency. With SyntheFi, users can buy and sell tokenized stocks with greater speed and at lower costs than traditional stock exchanges.

By leveraging the power of distributed ledger technology, SyntheFi is able to bring greater transparency, security, and efficiency to the stock trading process. Its innovative approach to stock trading has the potential to disrupt the traditional industry, making it easier for investors around the world to participate in the stock market. In this report, we will explore the features and benefits of SyntheFi, as well as its potential to revolutionize the way that stocks are traded.

4.2 Technology Stacks

1. HardHat

"Hardhat is a tool for building and deploying Ethereum blockchain applications. It is a development environment that provides a set of libraries and tools for building decentralized applications (DApps) on the Ethereum platform. Hardhat is written in JavaScript and is built on top of the Ethereum Virtual Machine (EVM), which is a runtime environment for executing smart contracts on the Ethereum blockchain."[5]

Hardhat is designed to be easy to use and provides a set of features that make it suitable for developing and testing Ethereum DApps. Some of the features of Hardhat include:

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- A local development blockchain: Hardhat provides a local development blockchain that allows developers to test their DApps without the need for an internet connection or real Ethereum tokens.
- Smart contract compilation and deployment: Hardhat has built-in support for compiling and deploying smart contracts, which are the core building blocks of Ethereum DApps.
- Testing utilities: Hardhat includes a suite of testing utilities that make it easy to write and run automated tests for your DApps.
- Integration with other tools: Hardhat can be used in conjunction with other tools, such as Truffle and Embark, to further enhance the development process.

Overall, Hardhat is a powerful tool that helps developers build and deploy Ethereum DApps quickly and easily.

2. Solidity

Solidity is a programming language for writing smart contracts that run on the Ethereum Virtual Machine (EVM). It is a high-level language that is designed specifically for writing smart contracts and is influenced by languages such as JavaScript, Python, and C++.

Smart contracts are self-executing contracts with the terms of the agreement between buyer and seller being directly written into lines of code. The code and the agreements contained therein are stored and replicated on the Ethereum blockchain.

Solidity is a statically typed language, which means that variables must be declared with a specific type (such as uint256 for a 256-bit unsigned integer) before they can be used. Solidity also supports various types of data structures, such as arrays and structs, as well as function visibility and inheritance.

One of the key features of Solidity is its support for contract inheritance, which allows a contract to inherit the functions and variables of another contract. This makes it easier to reuse code and create more modular and maintainable smart contracts.

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Overall, Solidity is an important language for developers working with the Ethereum platform and is widely used in the development of decentralized applications (DApps).

3. Goerli Test Network

Goerli is a public Ethereum test network that is designed for testing and development purposes. It is a proof-of-authority (PoA) network, which means that the validators (also known as "miners") are selected by the Ethereum community and are responsible for validating transactions and creating new blocks on the blockchain.

The Goerli test network is intended to be a more stable and reliable testing environment compared to the other public test networks, such as Rinkeby and Kovan. It is also more representative of the main Ethereum network, as it uses the same consensus algorithm (PoA) and block time (approximately 15 seconds).

Developers can use the Goerli test network to test their decentralized applications (DApps) and smart contracts without having to spend real Ethereum tokens. They can also use it to test new features and improvements to the Ethereum platform before they are deployed to the main network.

Goerli is maintained by a group of volunteers from the Ethereum community and is supported by the Ethereum Foundation. It is an important resource for developers working on the Ethereum platform and provides a valuable testing environment for DApps and smart contracts.

4. Chai

Chai is a JavaScript assertion library that can be used for writing test cases for Node.js applications. It provides a simple and expressive syntax for making assertions about the behavior and output of your code.

Chai is often used in conjunction with a testing framework, such as Mocha or Jasmine, to organize and run test cases. It can be used to test both synchronous and asynchronous code and provides a wide range of assertion methods for testing various aspects of your code. In

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this example, the assert.equal method is used to make an assertion that the result of calling the add function with the arguments 1 and 2 is equal to 3. If this assertion is true, the test case will pass. If it is false, the test case will fail.

Chai is a popular choice for writing test cases in JavaScript due to its simple syntax and wide range of assertion methods. It is an essential tool for any developer working on a Node.js application and helps ensure that your code is reliable and bug-free.

5. Alchemy

"Alchemy is a web3 platform that provides developers with tools and services for building and deploying decentralized applications (DApps) on the Ethereum blockchain. It offers a suite of developer tools and APIs that make it easier to work with Ethereum and build DApps more efficiently." [8]

Some of the features of Alchemy include:

- A local development blockchain: Alchemy provides a local development blockchain that allows developers to test their DApps without the need for an internet connection or real Ethereum tokens.
- Smart contract compilation and deployment: Alchemy has built-in support for compiling and deploying smart contracts, which are the core building blocks of Ethereum DApps.
- Testing utilities: Alchemy includes a suite of testing utilities that make it easy to write and run automated tests for your DApps.
- A real-time API: Alchemy provides a real-time API that allows developers to access data from the Ethereum blockchain in real-time.
- Integration with other tools: Alchemy can be used in conjunction with other tools, such as Truffle and Embark, to further enhance the development process.

Overall, Alchemy is a powerful platform for building and deploying Ethereum DApps. It provides a range of tools and services that make it easier for developers to work with Ethereum and build high-quality DApps more efficiently.

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6. Chainlink price feeds

“Chainlink is a decentralized oracle network that allows smart contracts on the Ethereum blockchain to securely access off-chain data feeds, web APIs, and other resources. One common use case for Chainlink is the provision of price feeds for various cryptocurrencies and other assets.” [6]

A price feed is a data stream that provides real-time or near real-time pricing information for a particular asset. Price feeds are used by smart contracts to execute certain actions based on changes in the price of the asset. For example, a smart contract might be designed to execute a trade on a decentralized exchange when the price of a certain cryptocurrency reaches a certain threshold. In this case, the smart contract would need to access a reliable price feed for the cryptocurrency in order to determine when to execute the trade.

Chainlink price feeds are provided by independent oracle providers who are responsible for sourcing and updating the data. These oracle providers may use a variety of methods to obtain pricing information, such as scraping data from exchanges or aggregating prices from multiple sources.

Chainlink price feeds are considered to be secure and reliable because they are decentralized and based on a network of independent oracle providers. This means that the data cannot be manipulated by a single entity, and the network as a whole is resistant to censorship and tampering.

Overall, Chainlink price feeds provide a key service for the Ethereum ecosystem by enabling smart contracts to access accurate and reliable pricing information.

7. Chainlink Keepers

“Chainlink Keepers are a type of node within the Chainlink network that are responsible for maintaining the integrity and reliability of the network. Specifically, Chainlink Keepers perform two key functions:” [7]

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1. They act as oracle providers by sourcing and updating data for the Chainlink price feeds and other types of data streams. This includes verifying the authenticity and accuracy of the data, as well as ensuring that it is delivered to the network in a timely and consistent manner.
2. They act as validators by participating in the consensus process that ensures the integrity of the Chainlink network. This includes verifying the authenticity of transactions and blocks, as well as participating in the voting process to determine the validity of data and the addition of new nodes to the network.

Chainlink Keepers are rewarded for their contributions to the network with a portion of the fees paid by users who request data or services from the network. They are also incentivized to maintain the reliability and integrity of the network through a reputation system, which allows them to earn higher rewards by providing high-quality data and services.

In summary, Chainlink Keepers play a critical role in the operation and maintenance of the Chainlink network by providing reliable data streams and participating in the consensus process to ensure the integrity of the network.

8. Chainlink API CAlls

An API (Application Programming Interface) is a set of protocols, routines, and tools for building software and applications. An API allows different software systems to communicate with each other and share data and functionality.

In the context of the Chainlink network, API calls refer to requests made by external systems or applications to access data or services provided by the network. These API calls can be made using standard HTTP requests, and they typically follow a set of rules and conventions defined by the API provider.

There are several types of API calls that can be made to the Chainlink network, depending on the data or services being requested. Some examples include:

1. Fetching data from a Chainlink price feed or other data stream. This could include real-time or historical pricing data for a particular cryptocurrency or asset.

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2. Submitting a request for a specific type of data or service. This could include requesting a quote for a data feed or other service, or submitting a request to execute a smart contract on the Ethereum blockchain.
3. Monitoring the status of a request or transaction. This could include checking the status of a request for data or service, or checking the status of a smart contract execution on the Ethereum blockchain.

Overall, API calls to the Chainlink network allow external systems and applications to access data and services provided by the network in a secure and reliable manner.

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CHAPTER 5

Proposed Implementation

The following is proposed based on the analysis of related works.

The Protocol name will be SyntheFI

And will use SYN as a default token

5.1 SyntheFI Assets (synAssets): Democratizing Real-World Assets

SyntheFI protocol is a DeFi application that will enable the issuance of synthetic assets, crypto tokens that are soft pegged to the price of real-world assets like equities. These tokens give the investors exposure to the price of real-world assets without needing to possess any of them.

Traders who are not fortunate enough for geographical or financial reasons will stand to profit from their price changes. Also, synthetic assets can be rapidly exchanged with other synth assets on automated market makers (AMMs) like Uniswap.

5.2 Interacting with synAssets

SynAssets is the name given to any synthetic asset on SyntheFI protocol. Before creating or minting a synAsset, the user must deposit collateral to the protocol, typically amounting to more than 150 per cent of the current value of the asset in real life. The protocol will accept stable currencies such as USDC or USDT and synAssets as collateral. If the value of the real-life asset exceeds the value of the user's collateral, the user's collateral will be liquidated to maintain the system's solvency. If users wish to redeem their collateral, they must delete the synAssets. In addition, users can also trade synAssets via liquidity pools on AMMs such as Uniswap. synAssets can be traded 24 hours a day, seven days a week but can only be minted during actual market hours (keeping with the stocks and bonds that serve as their underlying index value).

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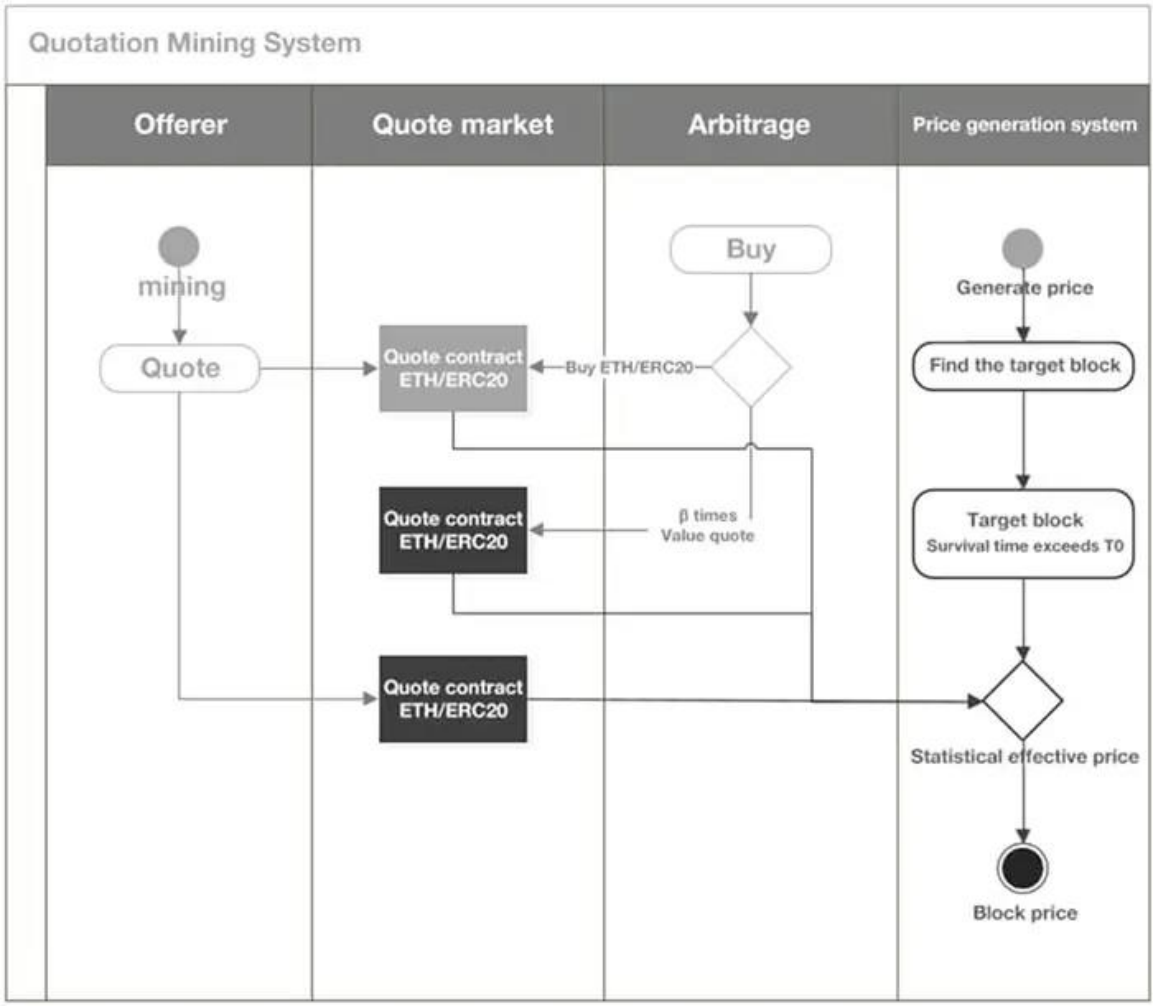

Figure 5.2.1: Quotation mining system

5.3 The synAsset Pricing Mechanism

SyntheFI protocol will receive price information for the assets its tokens represent from decentralized oracles every 30 seconds. The peg is then preserved by a few unique mechanisms such as minting liquidations, arbitrage and governance. These are the core components of the whole SyntheFI ecosystem. If the actual asset price increase and the collateral ratio put against the synAsset no longer surpasses 150 per cent minimum collateralization ratio (MCR), a minting liquidation will occur. The protocol instantly sells the collateral to acquire the synAsset until the collateral ratio surpasses the minimum ratio. This converges the synAsset price to its real-world counterpart.

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Arbitrageurs will also contribute to keeping the stability of the soft peg by taking advantage of any price discrepancy that may occur. For example, if any synAssets fall below their real-world counterpart's price, arbitrageurs will buy them in hopes of selling them for the actual world price later.

Governance will also promote the selling and minting of synAssets, in combination with assisting the restoration of broken price pegs. In addition, Syn token holders can vote to increase or reduce the minimum collateralization ratio or introduce transaction fees.

5.4 Protocol Design

Anyone can issue and exchange collateralized assets in stablecoins and synAssets, tracking the price of everything from traditional equities to cryptocurrencies.

- To **create **a synAssets, a user must lock up 150% of the current asset value in USDC or other synAssets as collateral. This governs minting, as collateral can be liquidated if the minimum collateral ratio is not maintained.
- To redeem a synAssets and receive the collateral, the user must burn the same amount of synAssets issued when opening the CDP.
- To trade a synAssets, the assets are listed on Uniswap. SYN also serve to incentivize liquidity providers to trade.
- To ensure synAssets, the method employs a decentralized pricing oracle that is updated every 30 seconds and tied to the tangible asset. When the cost of a synAssets drifts, traders are incentivized to arbitrage to claim the collateral.

5.5 The SYN token

The SyntheFI token (SYN) is SyntheFI Protocol's fairly distributed governance token. The SYN token has two main features:

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- **Captures CDP closure fees: **When SyntheFI When a CDP is closed, a 1.5 per cent fee is assessed on the collateral. Daily fees are accumulated and used to purchase SYN tokens on Uniswap, which are, in turn, paid to SYN-UST-LPs on Uniswap.
- **Protocol governance: **The SyntheFI token can change significant parameters in the protocol, such as the trading fee take rate and the position fee. It can also make spending proposals against the on-chain community pool holding SYN tokens, which can fund developer grants and add incentives to the protocol.

    - **CDP:** Collateralized debt position
    - **L.P.:** Liquidity provider

5.6 Governance

1. Ability to set critical economic aspects
2. Ability to vote on community pool budget proposals
3. (i.e., determine how the X per cent of tokens allocated to the pool can be spent)
4. Vote on which the protocol should cover assets.

- **Gov**: Permit decentralized control over other SyntheFI contracts. Share SYN with SYN participants.
- **Mint**: Handle CDP creation, management, and liquidation
- **Oracle**: Enable oracle feeds to publish synAsset prices.
- **Staking:** Distribute SYN rewards from block reward to L.P. stakers

- **Collector:** Collect protocol fees on CDP withdrawals and liquidations and forward them to the Government.
- **Community:** Budget the Community Pool account
- **Factory:** Organize all additional agreements on SyntheFI

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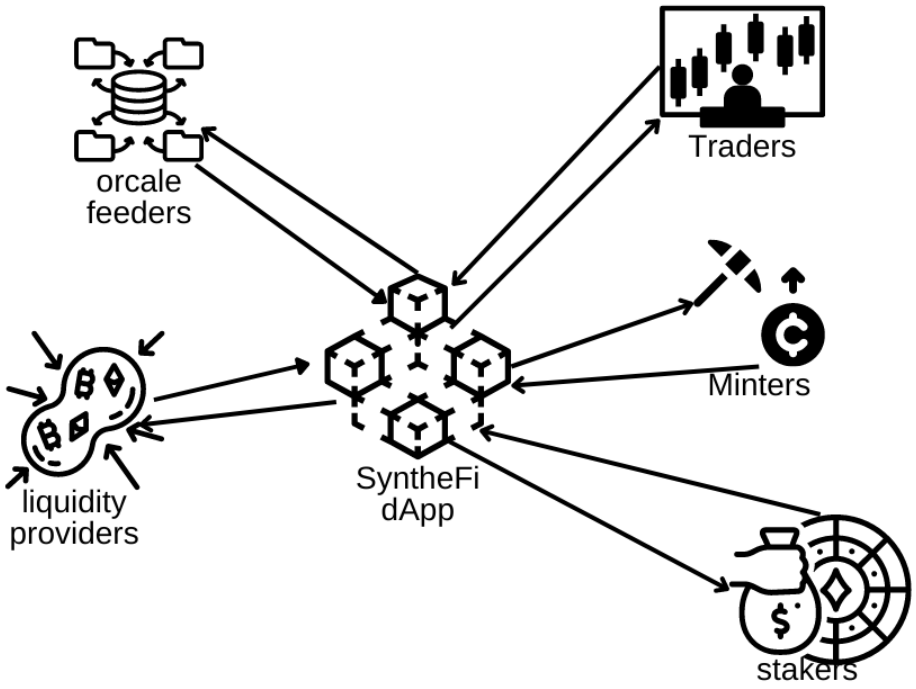

Figur**e** 5.6.1: Protocol Architecture

5.7 Pre requirements

1. React
2. NextJs
3. Material UI
4. Web3ui kit
5. Moralis
6. NodeJs
7. Express
8. Solidity
9. Hardhat
10. IPFS
11. Fleek

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12. Axios
13. Ether
14. Chai
15. AggregatorV3Interface

5.8 Tools Used For Building and Deployment

TABLE 1: TOOLS AND TECHNOLOGIES USED FOR BUILDING AND DEPLOYMENT

Tools	Used For
Solidity	For writing smart contracts
Hardhat	For deploying smart contracts
Goerili Test Network	For deploying smart contracts in test network.
Chai	Used for writing unit testing.
solidity-coverage	Used for getting testing code coverage data.
Alchemy	For getting local blockchain network.
Chainlink Price feeds	Used chainlink for fetching realtime oracle stock price feeds in USD.
Chainlink Keepers	Used to adjust real time stock price with token automatically
Mocking	Used to make fake API to speed up development process.
hardhat-gas-reporter	Used for getting gas report in table chart with every transaction.
Fleek	Used to deploy frontend in multiple node in a decentralized way.
Nextjs	Used for developing frontend.
React-moralis	For interacting with smart contract from frontend.
Axios	Used for making api request.
Material UI	Used for styling frontend.

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5.9 Smart Contract Algorithm

Step 1: Define state variables for Minimum USD amount, owner address, funders address, and price feed.

Step 2: Create a modifier to verify that only the stock owner can withdraw and check the balance.

Step 3: Convert minimum USD value in eth using aggregatorV3Interface contract.

Step 4: Get the recent USD conversion price from coinmarketcap API.

Step 5: Get stock price feed from chainlink price feed using aggegatorS3Interface.

Step 6: Create a function to get the up-to-date stock price in USD.

Step 7: Update the stockholder's money as the stock price changes.

Step 8: Save the stockholder's address storage variable.

Step 9: Create a function to get the stockholder's stock price in USD.

Step 10: Create a public payable function to allow funders to withdraw their stock balance.

Step 11: Convert maximum storage variables to immutable or memory-type variables to reduce gas cost.

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5.10 System Interface

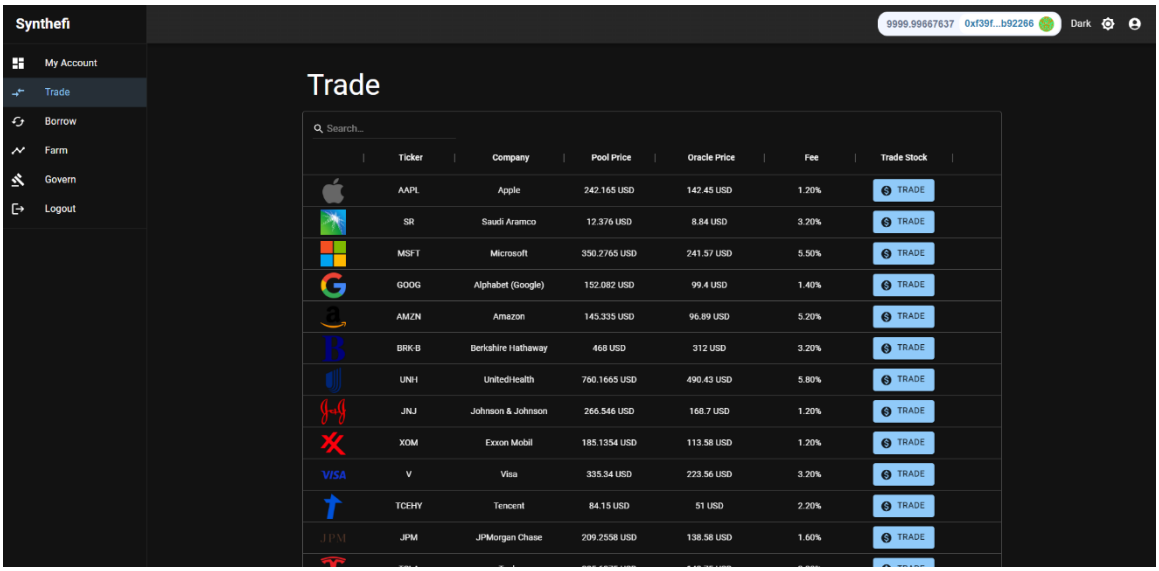

Figure 5.10.1: Stock price feeds

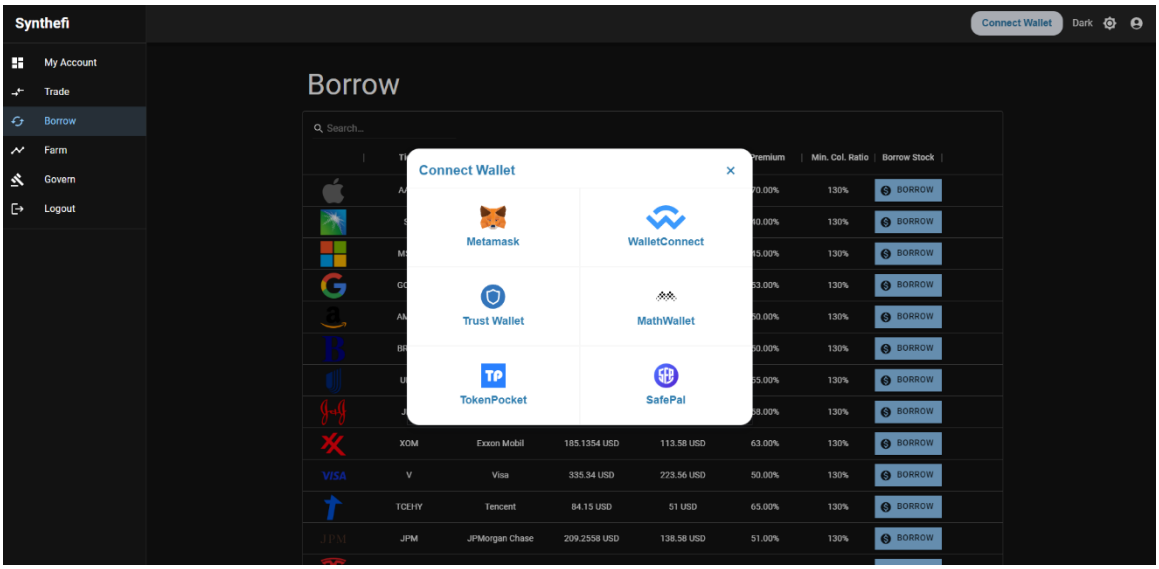

Figure 5.10.2: Different wallet Options

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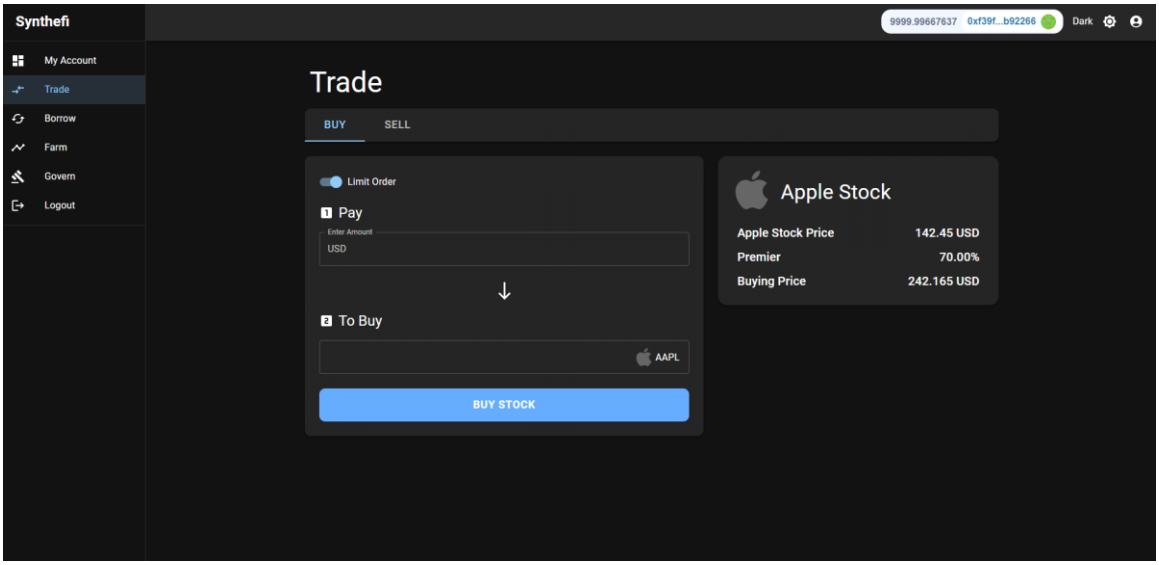

Figure 5.10.3: Buying Apple stock

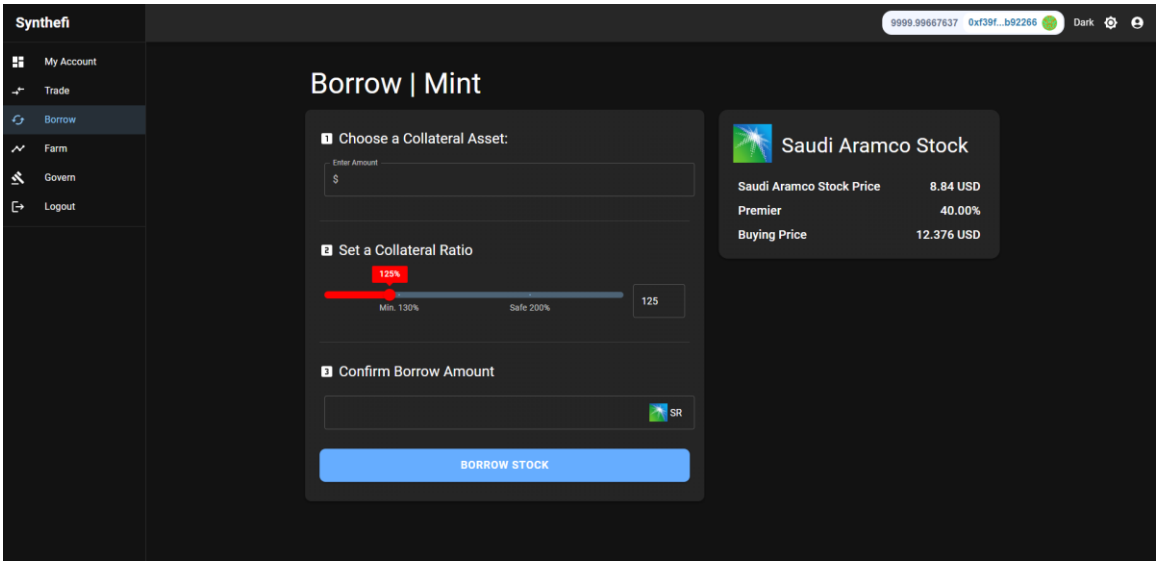

Figure 5.10.4: Borrow or Minting Option

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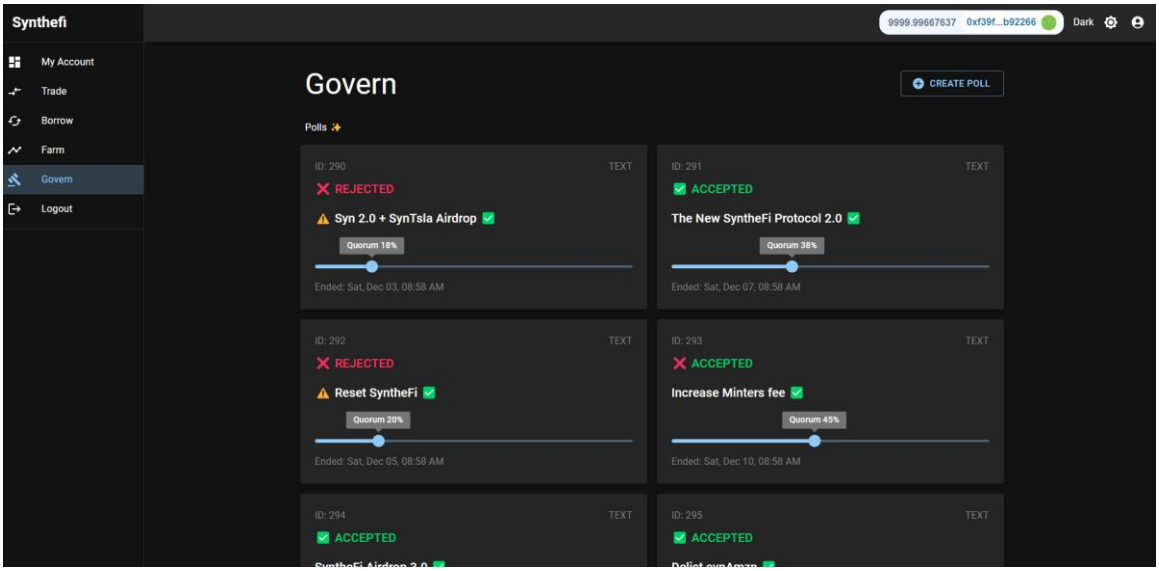

Figure 5.10.5: SyntheFi Governance Interface

In the Ethereum blockchain, gas is a unit of measurement used to determine the number of computational resources required to execute a particular operation or transaction. Every operation or transaction on the Ethereum blockchain requires a certain amount of gas, and the cost of executing that operation or transaction is denominated in Ether (ETH), the native cryptocurrency of the Ethereum network.

The gas report on Ethereum is a tool that allows users to view the current state of the Ethereum network in terms of gas usage and prices. The gas report provides information on the average gas price, the average gas usage, and the gas limit for the current block. It also displays the current pending transactions and their corresponding gas fees.

Users can use the gas report to determine the optimal gas price for their transactions and to estimate the cost of executing their operations or transactions on the Ethereum network. A gas report is an essential tool for users to understand the current state of the Ethereum network and to make informed decisions about their transactions.

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Solc version: 0.8.7	Optimizer enabled: false	Runs: 200	Block limit: 30000000 gas
Methods			
Contract	Method	Min	Max	Avg	# calls	usd (avg)
FundMe	cheaperWithdraw	-	-	77744	2	-
FundMe	fund	87366	104466	95916	10	-
FundMe	withdraw	-	-	35640	2	-
Deployments				% of limit		
FundMe	-	-	1058623	3.5 %	-
MockV3Aggregator	-	-	569635	1.9 %	-

Figure 5.10.6: Gas report

Etherscan is a blockchain explorer and analytics platform that allows users to view, analyze, and interact with smart contracts on the Ethereum blockchain. Etherscan provides a user-friendly interface for users to search for and view smart contracts by their address, transaction hash, or block number.

Users can view the source code of a smart contract on Etherscan and the contract's associated transactions, events, and internal transactions. Etherscan also provides tools for users to verify the correctness and security of a smart contract's code.

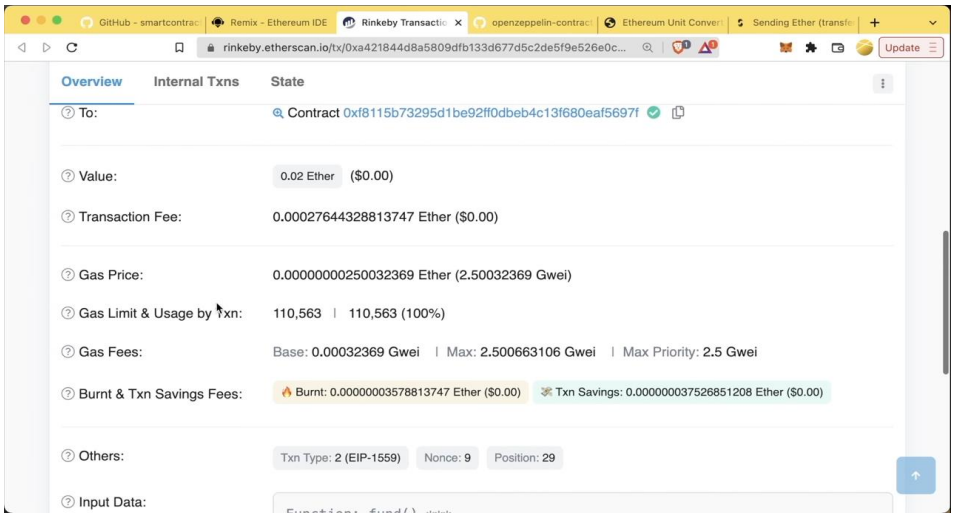

Figure 5.10.7: Smart contract in etherscan

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5.11 System Implementing Platform

“InterPlanetary File System (IPFS) is a peer-to-peer protocol for sharing and storing files. It aims to make it easier to share and access data over the internet, and to do so in a decentralized way that avoids the need for a central server or authority.” [9]

Here's how it works:

1. When you add a file to IPFS, it is given a unique identifier called a hash. This hash is calculated based on the contents of the file, so any changes to the file will result in a different hash.
2. The file is then broken up into smaller pieces, called blocks, which are distributed to multiple computers, or "nodes," on the IPFS network. These nodes store copies of the blocks and make them available for retrieval.
3. When you want to access a file on IPFS, you use its hash to locate the blocks that make up the file. The blocks are then retrieved from the nodes that are storing them and reassembled into the original file.
4. Since the blocks are distributed across multiple nodes, there is no single point of failure. This makes IPFS a more resilient and reliable way to store and access data compared to traditional centralized file systems.

Overall, IPFS is designed to make it easier to share and access data on the internet, while also addressing some of the challenges of centralized systems, such as dependence on a single server or authority.

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CHAPTER 6

Conclusion and future work

6.1 Future work

There are several directions that future work could take in the development and implementation of SyntheFi

1. Expanding the range of assets available for tokenization: Currently, SyntheFi only supports the tokenization of stocks. However, there is a wide range of other financial assets that could potentially be represented on the blockchain using the SyntheFi protocol.
2. Improving scalability: As the adoption of SyntheFi grows, it will be important to ensure that the protocol is able to handle a large number of transactions without experiencing delays or other issues.
3. Enhancing security: Ensuring the security of the SyntheFi protocol will be critical in order to protect user assets and maintain trust in the system. This could involve implementing additional security measures and conducting regular audits.
4. Developing new use cases: The tokenization of stocks enabled by SyntheFi opens up a wide range of potential use cases beyond simply buying and selling assets. For example, SyntheFi could be used to facilitate fractional ownership or enable the creation of new investment products.
5. Integrating with other DeFi protocols: SyntheFi could potentially be integrated with other DeFi protocols, enabling the creation of even more complex financial products and use cases.

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6.2 Conclusion

The capacity to tokenize any asset and trade it freely from anywhere globally, at any time of day or night, is a significant financial advancement. It gives individuals access to markets they would not otherwise be able to enter, equalizing everyone's financial freedom. As the usage of synAssets increases, we can trade, invest, and save without the current restrictions. It is the financial power that is decentralized. Young traders need more confidence in Wall Street and the institutions that comprise our current financial systems. They have an excellent option with SyntheFI Finance, and as the platform expands, the amount and kinds of assets that may be utilized as synAssets will increase.

In conclusion, SyntheFi is a promising new decentralized finance (DeFi) protocol that allows for the tokenization of stocks. This innovative approach allows ownership representation in traditional financial assets to be seamlessly transferred onto the blockchain, enabling a wide range of new use cases and opportunities. The potential benefits of SyntheFi include increased accessibility, liquidity, and reduced transaction costs, making it a valuable addition to the DeFi ecosystem. While there are certainly challenges and risks to consider, the potential for SyntheFi to revolutionize how we think about and interact with traditional financial assets makes it an exciting development.

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