Çankaya University
Faculty of Engineering
Computer Engineering Department

Project Report
CENG-408
Crypto Currency, Transaction and NFT Creation
Team ID: 202209
Advisor: Prof. Dr. Ahmet Coşar

Eylül Aktuy   201811004
Fatma Buse Çinkaya   201811019
İdil Taşdan   201811055

Table of Contents

Abstract

This documentation aims to provide information about our project, "Crypto Currency, Transaction, and NFT Creation," including the Project Web Page, Project Plan, Literature Review, SRS (Software Requirements Specification), and SDD (Software Design Document), Test Plan & Result, User Manual, Project Poster.

Blockchain promises the security of our information while using the web. There are many features that are used simultaneously with this Blockchain technology. The technology we want to work on is the cryptocurrency space.

Cryptocurrencies are a groundbreaking new technology that has more than 10000 types and is used in different fields thanks to the advanced developments in the field of Blockchain.

NFT is like a crypto token, what makes it special is that these crypto tokens represent an asset other than the average crypto tokens. These tokens are unique and owned by an individual.

Keywords: Crypto Currency, NFT, Project Plan, Literature Review, Software Requirements Specification, Software Design Document

Özet

Bu doküman, Proje Planı, Literatür Taraması, SRS (Yazılım Gereksinimleri Spesifikasyonu) ve SDD (Yazılım Tasarım Belgesi), Test Planı, Test Sonuçları, Kullanım Kılavuzu dahil olmak üzere "Kripto Para Birimi, İşlem ve NFT Oluşturma" projemiz hakkında bilgi vermeyi amaçlamaktadır.

Anahtar Kelimeler: Kripto Para Birimi, NFT, Proje Planı, Literatür Taraması, Yazılım Gereksinimleri Şartnamesi, Yazılım Tasarım Belgesi

1. Introduction

Our project intends to develop a new cryptocurrency, a cryptocurrency wallet web application, and our own NFTs (if possible, tradeable with our own tokens). This project, we believe, will teach us the fundamentals of how blockchains and cryptocurrencies work, as well as how these new technologies are developed.

There are many ways to check these online tokens in our favor. One such method is the "Crypto wallet", which helps us control our money online, just like a physical wallet that holds our credit cards and money. But our regular wallet can always be lost or stolen. Crypto wallets ensure this doesn't happen to you.

2. Literature Review

2.1 Abstract

Blockchain promises to protect our information while we use the internet. Many features of this Blockchain technology are used concurrently. The field of crypto currency is where we want to focus our efforts.

Cryptocurrency is a game-changing new technology that now has over 10,000 varieties and is used in a variety of fields, thanks to advanced developments in the field of Blockchain. There are also numerous applications for these tokens. Crypto wallets are the ones we wanted to work with. We use these online wallets to secure our currencies as well as to purchase digital and physical products.

We also wanted to program the product side of these transactions. NFT is like a crypto token, but what distinguishes it from other crypto tokens is that it represents a valuable being. These tokens are one-of-a-kind and belong to a single person. An NFT can be made in a variety of ways. A rare playing card from your collection, as well as a rare painting, are currently available. As a result, we intend to develop our own NFTs as part of this project.

Özet

Blockchain, web'i kullanırken bilgilerimizin güvenliğini sağlar. Bu Blockchain teknolojisi ile aynı anda kullanılan birçok özellik vardır. Üzerinde çalışmak istediğimiz teknoloji, kripto para birimi alanıdır. Kripto para birimleri, Blockchain alanındaki ileri gelişmeler sayesinde farklı alanlarda kullanılan ve 10000'den fazla türü olan çığır açan yeni bir teknolojidir. [1]. Ayrıca bu belirteçleri kullanmak için birçok uygulama var. Çalışmak istediğimiz kripto cüzdanlar, bu çevrimiçi cüzdanlar para birimlerimizi güvence altına almak ve ayrıca bu cüzdanları kullanarak dijital ve fiziksel ürünler satın almak için kullanılır. Biz de bu süreçlerin diğer tarafı olan ürünleri kodlamak istedik. NFT bir kripto jetonu gibidir, onu özel kılan şey, bu kripto jetonlarının ortalama kripto jetonları dışında değerli bir varlığı temsil etmesidir. Bu belirteçler benzersizdir ve bir kişiye aittir. Bir NFT oluşturmanın birçok yolu vardır. Nadir bir oyun kartı, Nadir bir resim ve koleksiyonunuzdan çok daha fazlası artık mevcut. Bu nedenle bu projede kendi NFT'lerimizi oluşturmak istiyoruz.

Anahtar Kelimeler: Blockchain, Crypto Tokens, Crypto-currency, NFT, Crypto Wallets

2.2 Introduction

Blockchain and web 3.0 are areas that are important and invested in today. There are currently 3 web versions. Web 1.0 was a system where users could only read information from websites. Web 2.0 allowed these users to both add entries and read data from these websites. In response, the site founders accessed people's personal data on these sites. This is where the problem of Web 2.0 comes in. Website users had to trust the website owner to protect their information, but the website owner can abuse this trust by any means.

Web 3.0 and Blockchain have entered our lives as the solution to this problem. Powered first by Bitcoins, then by smart contracts, the Ethereum Blockchain was built for greater security and reliability during online shopping, yet these cryptocurrencies hold their own values, and we can use these digital amounts of money just like regular paper money. In other words, Crypto Tokens are a form of digital payment and something investors can contribute to [2].

There are many ways to control these online tokens in our favor. One of these methods is the "Crypto wallet" which_ helps us to control our online money, just like a physical wallet holding our credit cards and money. But we can always lose our normal wallet, or it might get stolen. Crypto wallets make sure that this does not happen to you.

2.3 Blockchain

Blockchain, which has a chain structure conforming to blocks, is a distributed database system that provides translated sale shadowing. In plutocrat transfers, each step creates a block. For illustration, each of the information is like the sender's name and the quantum transferred is a block. These blocks created during the transfer process are translated, no way changed, and made unbreakable. For business processes to operate safely and efficiently, information must be transferred as snappily and directly as possible. The main benefit of blockchain at this point is that it's a tally that only network members with authorization can pierce. Also, members who can pierce the system cannot make any changes to the data. Another point that makes Blockchain

ideal is that it has a structure that can be participated in and provides transparent information. This is a reassuring element for the stoner.

How Blockchain Works?

Blockchain doesn't have a centralized system. Data in the blockchain can be penetrated via all computers. In addition to penetrating information, it's also possible to transparently pierce information like who the deals made then belong to and when they were made. Since the deals made in this technology cannot be changed, a new record is added to the system when. correction is requested. Therefore, all details are defended, and all correct and incorrect deals can be observed. In blockchain technology, the identity is created as a stoner identification number honored by all networks. therefore, rather than using information like the stoner's name and surname, all deals are made with this identification number. The deals made then are translated with fine computations in the stoner's system, that is, hash functions, and recorded on the chain. Character strings created with hash functions correspond to letters and figures. In case of the fewest change, a different sequence is formed. All deals are vindicated by the stoner and the records come endless. This shows that this technology isn't consolidated. In short, the rudiments that make blockchain technology important are It has an anonymous structure, isn't a centralized system, and is unbreakable and unbackable.

What help does Blockchain technology offer?

Blockchain technology offers data sequestration with the capability to securely store the information it contains. To change the data contained then, you need to get a blessing from other blocks. This activates the evidence medium as much as the number of blocks. Therefore, the system ensures that the data is safe by precluding any good or vicious action that may come from the outdoors.

What Are the Uses of Blockchain?

Blockchain technology has a structure and function that can be used in numerous different sectors. They are the main sectors where this technology is extensively used:

- Crypto Currency,
- Public sector
- Fiscal sector,
- Energy sector,
- Health sector,
- and Supply chain.

2.3.1 History

Stuart Haber and W. presented the initial work on a blockchain that is cryptographically safe. In 1991, Scott Stornetta. Merkle trees were included into the design by Bayer, Haber, and Stornetta in 1992, which improved. Efficiency by enabling multiple documents to be aggregated into a block. The first blockchain was created in 2008 by a person (or group of individuals) going by the name Satoshi Nakamoto. The following year, Nakamoto included it as a fundamental part of the cryptocurrency bitcoin, acting as the network's central public ledger for all transactions. Bitcoin was the first digital currency to use a blockchain to solve the double spending issue without the need for a reliable authority, and this innovation sparked a wide range of new applications. The size of the Bitcoin blockchain file, which houses a record of every transaction that occurred on the network, hit 20 GB in August 2014. (gigabytes).

The size climbed to about 30 GB in January 2015, while the size of the bitcoin blockchain increased from 50 GB to 100 GB between January 2016 and January 2017. In Satoshi Nakamoto's original essay, the phrases "block" and "chain" were employed independently; but, by 2016, a single word, "blockchain," had gained popularity. New versions of the distributed blockchain database that initially surfaced in 2014 are referred to as "Blockchain 2.0." An implementation of this second-generation programmable blockchain, according to The Economist, is "a programming language that allows users to design more complex smart contracts, so that when a post arrives, they can be executed in real time." It generates payable invoices. Blockchain 2.0 technology enables "the exchange of value without strong intermediaries acting as arbitrators of money and information," going beyond transactions. They must respect participant privacy, allow people to "earn money on their own expertise," allow excluded people to participate in the global economy, and pay creators for their intellectual property. By "possibly changing the way equality is distributed," second-generation blockchain technology enables people to keep their "permanent digital identity and individuality" and contributes to the solution of the social inequality issue. To access any "external data or time-based events or market conditions to interact with the blockchain," blockchain 2.0 applications are still required to use an off-chain oracle as of 2016. The NSD) central securities depository has announced a pilot project based on the Nxt blockchain 2.0 platform that will investigate the use of blockchain-based automated voting systems. In July 2016, IBM established a research facility for blockchain innovation in Singapore. To examine the creation of blockchain-related governance frameworks, a working group for the World Economic Forum met in November 2016. Industry Trade Groups established the Global Blockchain Forum, a project of the Digital Chamber of Commerce, in 2016, using the diffusion of innovation principle, according to Accenture.

2.3.2 Structure and Design

A decentralized, distributed, and open digital ledger called a blockchain is used to track transactions among numerous computers. Therefore, unless all subsequent blocks have changed and the network has been comprehended, the record cannot be modified retrospectively. Participants can now audit and verify transactions on a budget thanks to this. Using a distributed timestamp server and peer-to-peer network, a blockchain database is independently controlled. They are supported by widespread cooperation that is motivated by shared self-interest. The result is a solid workflow where participants' concern over data security is barely noticeable. The unlimited replication property of a digital asset is eliminated using a blockchain. It resolves the long-standing issue of double spending by confirming that each unit value is passed just once. Blockchains have been referred to as a protocol for value exchange. Compared to conventional systems, this blockchain-based value exchange is more expedient, secure, and affordable. Because a blockchain offers a record that necessitates offer and acceptance, it can allocate property rights.>

Blocks

Stacks of legitimate transactions that have been hashed and encoded into Merkle trees are stored in blocks. Each block in the blockchain combines the cryptographic hash function of the previous block. Blocks joined together to create a chain. By going back to the first starting block, this iterative procedure checks the consistency of the prior block. Sometimes distinct blocks can be generated simultaneously, leading to the formation of a temporary fork. Any blockchain contains a special method for scoring many versions of the history so that one with a better value can be chosen over the others in addition to a secure hash-based date.

Block Time

The length of time it typically takes for the network to create a new block on the blockchain is known as the block time. On some blockchains, a new block is generated every five seconds. When the block is finished, the data it contains can be verified. Shorter block times result in speedier transactions since in the

world of cryptocurrencies, this occurs when money is transferred. While bitcoin's block time is 10 minutes, Ethereum's is set at 14 to 15 seconds.

Hard Forks

A hard fork is a rule modification, and software that has been approved in accordance with the previous rules will consider blocks created in accordance with the new rules to be invalid. A hard fork necessitates software upgrades on all nodes that will operate under the new rules. If some nodes keep using the outdated software while other nodes are utilizing the updated software, a split may happen. As an illustration, Ethereum underwent a hard fork to "integrate" investors in the DAO, which had been compromised by a hacker who used a flaw in its code. A split between the Ethereum and Ethereum Classic chains was the outcome of this fork. The hard fork that would result in a return of blockchain records was proposed to the Next community in 2014, and they were requested to evaluate it. After discussions and ransom payments, the hard fork offer was refused, and some of the money was eventually obtained. Most nodes running the new software could also revert to the previous set of regulations to prevent a permanent split, as happened with the March 12, 2013, Bitcoin split.

Decentralization

Blockchain avoids a variety of dangers associated with central data storage by storing data through a peer-to-peer network. Ad-hoc message transmission and distributed networking are both possible with decentralized blockchain. Hackers may use peer-to-peer blockchain networks for their own purposes. There are no significant security flaws in it. Similarly, there isn't a single point of failure. Public key cryptography is a technique used in blockchain security. The public key is a blockchain address that resembles a long, random string of integers. Value tokens transmitted across the network are identified as coming from this address. A secret key functions as a password-like means of accessing one's digital assets, or, to put it another way, a way to engage with the numerous features that the blockchain now allows. In general, data recorded on a blockchain is thought to be unbreakable. While information and data tampering are both feasible, centralized data is easier to control. Open blockchains create transparency at the public blockchain level by decentralizing data in a searchable ledger.

Openness

Even though they are accessible to the whole public, open blockchains are nonetheless easier to use than some conventional ownership records that demand physical access to be seen. There was debate regarding the concept of a blockchain because all early blockchains were permissionless. The question of whether a private system with validators hired and approved (commissioned) by a central authority could be regarded as a blockchain is one of the continuing arguments. The term "blockchain," according to proponents of permissive or private chains, can refer to any data structure that organizes data into time-stamped blocks. In databases, these blocks act as a distributed kind of "Multiversion Concurrency Control" (MVCC). Blockchains prevent two transactions from using the same single output in a blockchain because MVCC prevents two transactions from concurrently changing the same single item in a database. The systems' detractors claim that they lack support for decentralized data validation, are comparable to typical corporate databases, and make it easy for the operator to make unauthorized changes and alterations. Blockchain is a term used by business analysts Don Tapscott and Alexis Tapscott to refer to a public distributed ledger or database.

Permissionless (public) Blockchain

The main benefit of an open, permissionless, or public blockchain network is that access restriction and protection against malicious actors are not necessary. This means that the blockchain may be used as a transport layer and apps can be added to the network without requiring permission from others or their confidence. Blockchains are already secured by Bitcoin and other cryptocurrencies by requiring new entries to include a proof of work. Adam Back created the Hash cash puzzles in the 1990s, which are used by bitcoin to extend the blockchain. Decentralized blockchains have not received top priority from the financial sector. 2016 has seen a decline in venture capital funding for blockchain-related startups in the US, but an increase in China. Blockchains that are open (public) are used by Bitcoin and many other cryptocurrencies. Bitcoin has the largest market capitalization as of February 2021.

Permissioned (private) Blockchain

Permitted blockchains regulate network access using an access control layer. Private blockchain networks differ from public blockchain networks in that the network owner has control over the validators. They do not take advantage of the network effect or rely on anonymous nodes to validate transactions.

Blockchains with permissions can alternatively be referred to as "consortium" or "hybrid" blockchains. According to The New York Times, numerous companies' blockchain networks in 2016 and 2017 claimed to employ "private blockchains independent of the public system."

Disadvantages of Permissioned Blockchain

There is no need for a "51 percent" attack on a private blockchain, according to Nikolai Hampton, who wrote on Computerworld, "since the private blockchain (most likely) currently controls 100 percent of all blockchain resources." You might completely manage their network while using malicious blockchain creation tools on a private company server and alter your activities. This has a lot of grave negative consequences, particularly during financial or debt crises like the one that erupted in 2007–2008, when politically influential individuals may decide in favor of some groups at the expense of others. And "a huge collective mining effort protects the bitcoin blockchain. Any private blockchain is unlikely to make the time- and money-consuming attempt to preserve data using gigawatts of computer power. On a private blockchain, there isn't any incentive to utilize more power or find rivals earlier than their rivals, either. This implies that a lot of on-premises blockchain systems will just be large databases.

2.3.3 Types

The integration of blockchain technology into other fields is possible. Blockchains are mostly used as a distributed ledger for cryptocurrencies, most notably bitcoin, nowadays. While various central banks in nations like India, China, the United States, Sweden, Singapore, South Africa, and the United Kingdom have released a Central Bank Issued Cryptocurrency (CICC). Nothing of the sort has been done thus far.

Public Blockchains

A public blockchain has no access limitations at all. Anyone with internet access can send transactions there and sign up as a validator (i.e., participate in the execution of a consensus protocol). either a Proof of Work or a Proof of Stake algorithm. The bitcoin blockchain and the Ethereum blockchain are two of the biggest, most well-known public blockchains.

Private Blockchains

There is room for a private blockchain. It is exclusive to those who have been invited by the network administrators. Access for participants and authenticators is limited. Distributed Ledger (DLT) terminology is typically used for private blockchains to separate them from other peer-to-peer decentralized database technologies without open ad hoc computer clusters.

Hybrid Blockchains

A blockchain that is hybrid combines centralized and decentralized elements. Depending on whatever elements of centralization and decentralization are applied, the chain's precise operation may change.

Sidechains

A blockchain ledger known as a sidechain is one that functions in addition to a main blockchain. The sidechain can function independently of the main blockchain because it can link to and receive entries from the primary blockchain, where such entries often represent digital assets (e.g., using an alternative logging method, alternative consensus algorithm, etc.).

2.3.4 Uses

The integration of blockchain technology into other fields is possible. A distributed ledger for cryptocurrencies like bitcoin is the main use for blockchains; however, a few additional operational products also emerged from proof of concept in late 2016. As of 2016, some companies are experimenting with the technology and running low-level back-office applications to assess how blockchain affects organizational effectiveness. A total of $2.9 billion is thought to have been invested in blockchain technology in 2019, an increase of 89% from the previous year. Furthermore, according to International Data Corp, institutional spending on blockchain technology will total $12.4 billion by 2022. Additionally, blockchain technology has a potential for annual production, according to PricewaterhouseCoopers (PwC), the second-largest professional services network in the world. By 2030, the value of businesses will exceed $3 trillion. The 2018 PwC poll of 600 business leaders and a 2018 study that found 84% of respondents had at least some exposure to using blockchain technology used to support PwC's estimation. Blockchain was characterized as a technology with broad ramifications for business and society in the BBC World Service radio and podcast series Fifty Things That Make Up the Modern Economy. Tim Harford, an economist and

publisher of the Financial Times, talked about the obstacles that must be addressed as well as why the underlying technology may have broader uses. Initially released on June 29, 2019. Between 2016 and 2020, the number of blockchain wallets doubled to 40 million. The possible application of blockchain technology in sustainable management was highlighted in a 2022 article.

Cryptocurrencies

Most cryptocurrencies record transactions using blockchain technology. For instance, blockchain is the foundation of the Ethereum network as well as the Bitcoin network. On May 8, 2018, Facebook said that it would establish a new blockchain division under the direction of David Marcus, who formerly oversaw Messenger. On June 18, 2019, Facebook unveiled its intended cryptocurrency platform Libra (now known as Diem). A portion of the bitcoins used by Silk Road, the criminal enterprise running on Tor, have been seized because of blockchain and confiscation investigations by the US federal government. Regarding the legitimacy of its citizens or banks holding cryptocurrencies, governments have a variety of policies. Blockchain technology is being used by China in numerous sectors, including the introduction of a national digital currency in 2020. Similar initiatives have been started by Western countries, such as the European Union and the United States, to bolster their own currencies.

Smart Contracts

Smart contracts on the blockchain are suggested contracts that can be partially or totally enforced or implemented without involving a person. Automatic escrow is one of a smart contract's primary objectives. Smart contracts have the advantage that the blockchain network executes the contract on its own, eliminating the need for a trusted third party (such as a trustee) to act as an intermediary between the contractual parties. As a result, it may be easier for value to be transferred between businesses, which might pave the way for increased transaction automation. According to a 2018 IMF staff debate, blockchain-based smart contracts could minimize moral hazard risks and improve the use of contracts in general. There hasn't yet been a successful smart contract system, though.

Financial Services

According to Reason, an IBM study from September 2016 found that more institutions than expected have expressed interest in implementing distributed.

ledgers for use in banking and are working with businesses developing private blockchains. This technology has the potential to speed up back-office settlement systems, which is why banks are interested in it. The institutional understanding that the blockchain industry is essentially the foundation of a completely new financial industry, with all the consequences that involves, has risen as the sector approaches early maturity. Banks like UBS are creating brand-new blockchain research labs to investigate how blockchain technology might be applied to financial services to improve efficiency and cut costs. German bank Berenberg thinks blockchain is a "overhyped technology" with lots of "proof of concept," but also with many obstacles to overcome and few successes. Along with initial coin offerings, blockchain has also given rise to a new class of digital assets known as security token offerings (STOs), also known as digital security offerings (DSOs) (ICOs). STO/DSOs are used to represent both conventional assets like stock in a corporation and more novel assets like intellectual property, real estate, works of art, or specific products. They can be traded on either a private or public, regulated stock market. In this area, several businesses are operating, offering services for compliant tokenization, private STOs, and public STOs.

Games

Video games have made money using blockchain technology, including cryptocurrencies and immutable tokens (NFTs). In-game customization choices, such as character skins or other in-game products, are common in live service games. These items can be earned or purchased from other players using in-game currency. Since some nations consider video games to be equivalent to gambling and can lead to gray market issues like skin gambling, publishers frequently forbid players from making real money from games. However, several games also enable trade of virtual objects for real world currency. avoided. Players frequently have the option to exchange these in-game products for cryptocurrency, which can later be converted into real money, in blockchain games. The first game to use blockchain technology was Crypto Kitties, which was published in November 2017. The user used Ethereum to purchase NFTs, which each consisted of a virtual pet that they could breed with other NFTs to produce children with new NFT traits. In December 2017, a virtual pet in the game sold for more than $100,000, garnering media attention. A substantial bottleneck on the Ethereum network was caused by the fact that in the beginning of 2018, almost 30% of all Ethereum transactions were for gaming-related purposes, and Crypto Kitties

also addressed the [clarification needed] scalability concerns for gaming on Ethereum. Since these games tended to focus on using blockchain for speculation rather than more conventional game formats that gave little appeal to most players, there was not much success in video games using blockchain in the early 2020s. These games also carry a significant risk for investors because it might be impossible to estimate their revenue. Axis Infinity's modest success and business ambitions for metaverse material during the COVID-19 pandemic have increased interest in the area, nonetheless. In the second half of 2021, a concept known as "GameFi" will likely be supported by blockchain money and refer to the junction of video games and finance. The future for many significant publishers, including Take Two Interactive, Electronic Arts, and Ubisoft, are being seriously considered.

2.4   Crypto-currencies

Cryptocurrency is a decentralized, digital, or virtual currency that uses cryptography for secure financial transactions. The fact of crypto currency being decentralized helps them resistant to fraud and censorship.

The crypto currencies are used to serve as a medium of exchange for money to safeguard financial transactions, restrict the production of new ones, and confirm the transfer of assets. To replace traditional currencies with a more secure alternative, cryptocurrencies were developed. It belongs to the family of virtual currencies as well.

Importance

- These tokens are decentralized (decentralization means that the item is not controlled by governments, companies, and individuals).
- Cryptocurrencies can help make financial transactions less complicated.
- They can make financial systems more transparent and less corrupt.

Example Crypto currencies

BITCOIN (BTC)

Bitcoin is a decentralized, peer-to-peer online form of payment. At the time these two concepts were first mentioned by Satoshi Nakamoto, hence they were not tested at all. Bitcoins can perform anything a physical currency (paper money) can perform. The difference is that this digital currency isn't connected to any governments, individuals, or companies. It gives people the advantage.

to complete their transactions which only benefits these people, not a third-party group.

ETHEREUM (ETH)

Ethereum or Ether is a cryptocurrency that operates in the Ethereum Blockchain, which works using blockchain technology to create smart contracts and other decentralized applications. As a result, Ethereum is both a cryptocurrency and a software development sandbox.

TETHER (₮, USDT)

This currency was founded by Tether Limited, in July 2014. Its first name was Real Coin, which got changed to Tether in November 2014. The Unique thing about this currency is that it is stable, hence it is called a "Stable Coin" too. The value of a stable cryptocurrency is tied to a "stable" reserve asset, such as US dollars or gold. Tether's value was stabilized at 1 American Dollar.

BINANCE COIN (BNB)

The cryptocurrency known as Binance Coin, which trades under the sign BNB, is a product of the Binance exchange. With a $7.6 billion trading volume as of Q2 2022, Binance Exchange is the biggest cryptocurrency exchange globally.

2.5   Crypto Wallets

A cryptocurrency wallet is an account with software, hardware, and the owner's private key that may be used to purchase, sell, and (in most cases) sign transactions for the NFTs that were introduced to the world with the first cryptocurrency, Bitcoin. On a blockchain, private keys serve as account identifiers. By facilitating peer-to-peer connection (the protocol used to distribute data between user computers serving from two or more server computers), users can swap bitcoins thanks to this identification. Public and private keys are necessary to access a wallet address. Asymmetric cryptography is the use of two separate keys to open a wallet. Public and private keys are present in all crypto wallets.

Types of cryptocurrency wallets

Custodial (Hosted)

to store things. It provides storage in this type of storage system, but wallet services are provided by a central company, such as a cryptocurrency exchange. Even though it requires less responsibility, this system involves delegating control to another party. For instance, to transmit funds from a

storage wallet, a user would simply log in with a username and password, enter the recipient's public key, and leave the recipient's business to enter the recipient's secret password. The user is given a very straightforward answer as a result, but there is also an increased level of risk.

Hardware and Software

Software and hardware wallets are both types of digital wallets. The software wallet is an application that may be used on a user's computer or web browser and is used to buy, sell, and transfer Nfts and cryptocurrencies. A hardware wallet is a physical device that is physically connected to a computer. It is the best option for secure storage because it is not always connected to the computer and browser, but it is less suitable for fast or frequent transactions. Different wallets support various blockchains, but not all wallets support NFTs.

Non-Custodial

These wallets do not require outsourcing, giving you complete control. It offers strong protection against cyber-attacks while also denying access to anyone other than the user, as long as the private key information is kept secure. The private key, on the other hand, imposes a critical responsibility on the owner.

Hot and Cold wallets

Hot wallets are cryptocurrency wallets that are connected to the internet. These wallets can take the form of a browser extension, a mobile app, or a desktop app. Hot wallet are more convenient for quick and frequent transactions, but they pose a security risk due to their Internet connection. Cold wallets, unlike hot wallets, do not require an internet connection. These offline wallet types are the most secure way to store cryptocurrency. Cold wallets are popular among investors because they are physical devices like USB memory sticks, but they are inconvenient because they are not always connected to the internet.

2.6 NFTs

NFTs, known as non-fungible tokens, are digital assets and a unit of data stored on the blockchain that are not interchangeable because they are unique. NFTs are digital artifacts such as photos, videos, and GIFs. NFTs, which have been talked about recently, first made their name with Cripto Punks in 2017 and started to appear officially with Pixel Art projects. NFTs, which lost their popularity until 2020, came to the fore again with the works of the artist known as Beeple. NFT trading has become widespread as artists have the

opportunity to work efficiently during the pandemic days and transfer their art to digital media by making use of technology. Immutable tokens, namely NFTs, are the digital equivalent of works in the physical world. If we need to give examples of NFTs, products that are artistic works in the digital environment, sports cards and popular world pieces can be given as examples. These immutable virtual coins are copyrighted by virtue of their nature, and an artist can earn passive income by selling their work. NFTs are certificates that are linked to unique digital assets on the blockchain to protect their uniqueness and ensure the tangible rights of buyers are protected. Thanks to this system, it is impossible to copy, disassemble or change them. In this way, NFTs are ensured to be unique and add originality to the work. These assets, usually built on the Ethereum infrastructure, the most well-known altcoin, are created according to digital standards such as ERC-71 and ERC-1155. In addition to the Ethereum infrastructure, the makers of EOS, Neo and Tron have added trading diversity with their own coins to encourage NFT construction. Nowadays, it is possible to buy and sell with many cryptocurrencies.

Areas it is Used

The usage area of NFT has a growing market in the virtual environment. If we need to talk about these markets, we can talk about various fields such as games, music, cinema, and sports. For example, the slam dunk card of the famous NBA player Lebron James has become a work of art as NFT and is sold for $ 208,000. People who want to buy this NFT can have this NFT after paying this fee. Later, if he wants to resell this work, he can resell it to his fans at the price he has determined. Thanks to this cycle, prices are constantly changing, and they can rise to extremes or decrease in rare cases. In the game category, people can earn NFT by playing the games prepared by the producer companies and trade between each other. In the music category, the works of music groups and popular artists can also be sold in NFT. For example, rock bands like King of Leon and Lil Pump are examples. In the branches of Cinema and Sports, some frames from the movies were turned into NFT and to give an example from our country, Cem Yılmaz offered the handmade drawings of the characters he played as NFT today.

Security

Crypto wallets are used to secure NFT. Examples of these wallets are hot (software) and cold (hardware) wallets. The type of wallet most used by NFT markets are hot wallets. These wallets are special software wallets created for your personal accounts and are very easy to use. Cold wallets, on the other

hand, are not preferred, but nowadays they are available to those who use this type of wallet for NFT. Both wallets are trustworthy and your NFTs are kept with private keys.

Advantages and Disadvantages

By creating NFT, you can produce your own works of art and can easily buy and sell well-known works in the virtual environment and earn passive income from it. Since these works are uniquely stored in the digital environment, they offer a secure shopping system. Consuming a lot of electricity to produce NFT can be shown as the only disadvantage of this work, but it is aimed to eliminate this problem with the incentive of electricity generation.

3. Software Design Document (SDD)

3.1. Introduction

3.1.1 Purpose

This document contains information about creating a new Crypto currency, A Crypto wallet web application, and NFTs. This project includes information about the fundamentals of how blockchains and cryptocurrencies work and how these new technologies are developed. This document provides detailed information about the requirements of the project. It reflects the identified constraints and proposed software functionalities. Moreover, the SRS document explains how participants interact with the crypto wallet.

3.1.2 Scope of Project

Crypto currency is just like a regular currency (a unit of storage, account, and a means of exchange) but in a digital platform and accepted universally. Cryptocurrencies do not have a central issuing or regulating authority, instead using a decentralized system (Web 3.0) to record transactions and issue new units. Cryptocurrencies run on a distributed public ledger called blockchain, a record of all transactions updated and held by currency holders.

A Crypto-currency wallet is where you keep your private keys. It could be a dedicated device (hardware wallet), an app on your computer or smartphone, or even a piece of paper. Most users will rely on wallets to interact with a cryptocurrency network. Different types will provide varying levels of functionality, and a paper wallet cannot sign transactions or display current currency prices.

NFTs are tokens that we can use to represent ownership of unique items. NFT stands for non-fungible token. Non-fungible is an economic term that you

could use to describe things. These things are not interchangeable with other items because they have unique properties.

3.1.3.Glossary

TERM	DEFINITION
Blockchain	Blockchain is a method of recording information that makes it impossible or difficult for the system to be changed, hacked, or manipulated.
Cyrpto-Currency	A Cryptocurrency is just like a normal currency(a unit of storage and account and a means of exchange) but in a digital platform and accepted universally.
Cyrpto Wallet	A cryptocurrency wallet is an account with software, hardware, and the owner's private key that may be used to purchase, sell, and (in most cases) sign transactions for the NFTs that were introduced to the world with the first cryptocurrency, Bitcoin.
Non-Fungible Tokens (NFT's)	NFTs are digital assets and a unit of data stored on the blockchain that are not interchangeable because they are unique.

3.2. SYSTEM OVERVIEW

We examined our functional requirements and the languages out there which support objectives of this project and information we want to learn. As a result, in order to develop our Crypto-currency, we decided to use Solidify language and we want to release this crypt-currency on a Testnet of Ethereum (ex. Sepholia, Goerli, Rinkeby). For our Crypto wallet we decided to design a web application which acts as a wallet and can connect to Ethereum Testnet of our choice. In order to develop this, we decided to use Vite+React to develop our web server and application server, and as a database server, we decided to use MongoDB which is a NoSQL database service.

3.3..SYSTEM DESIGN

3.3.1 ARCHITECTURAL DESIGN

Web Server:

The web layer allows users to interact with the web wallet. We will use Vite provided by Visual Studio Code to design the Web layer.

Application Server:

Our application server is our second application layer. It will control our Web Server, connect to the Ethereum Blockchain to handle transactions and it will communicate with our Data Server. We will use Visual Studio Code's Vite + React services to develop our Application Server.

Data Server:

Our third layer, the database layer, stores the data and sends this data to the application server when needed. We aim to use Mongo DB as a database server.

3.4. SYSTEM MODELING
3.4.1 ACTIVITY DIAGRAMS
3.4.1.1. REGISTER ACTIVITY DIAGRAM
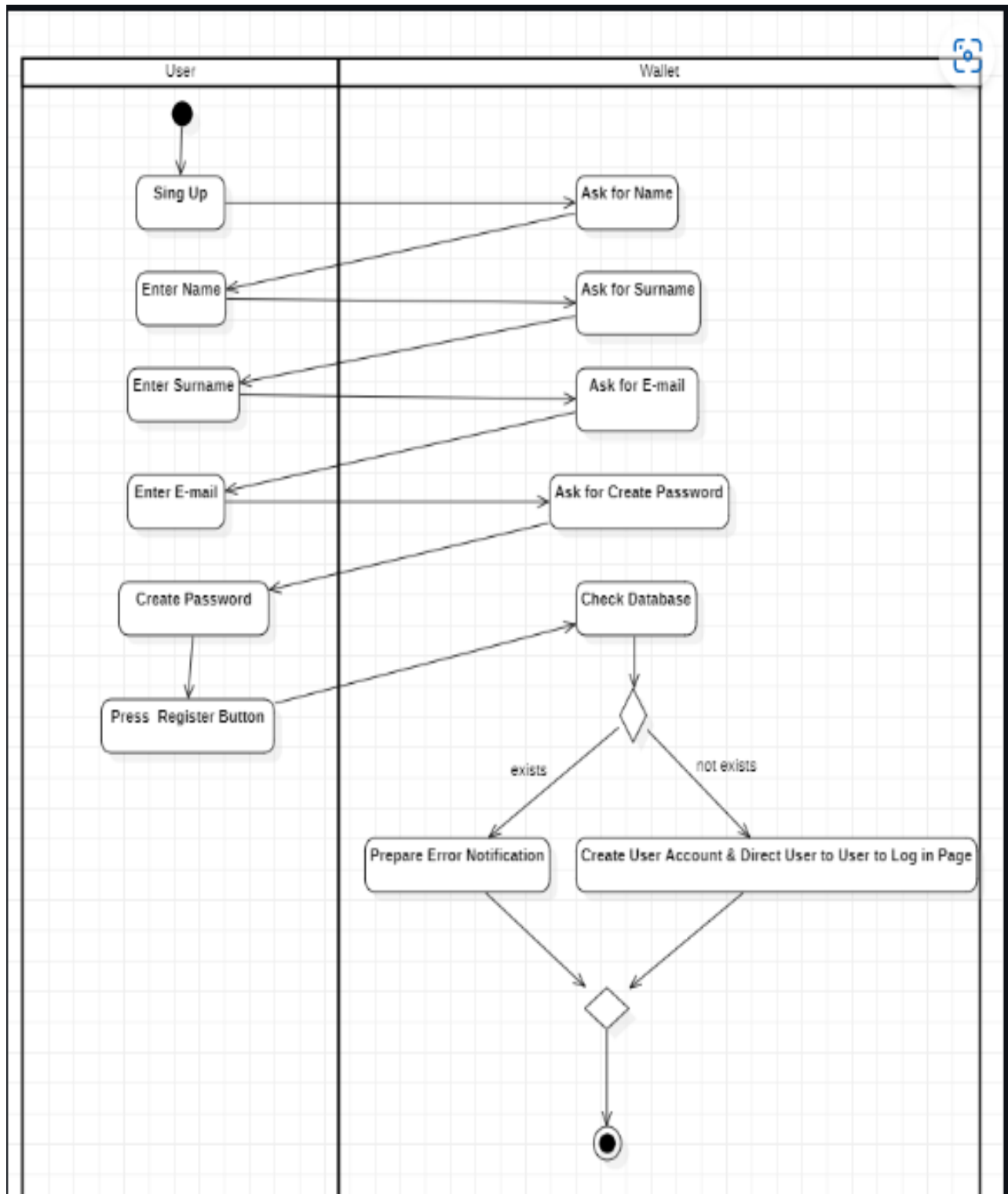
3.4.1.2. LOG IN & LOG OUT ACTIVITY DIAGRAMS
3.4.1.2.1 LOG IN ACTIVITY DIAGRAM
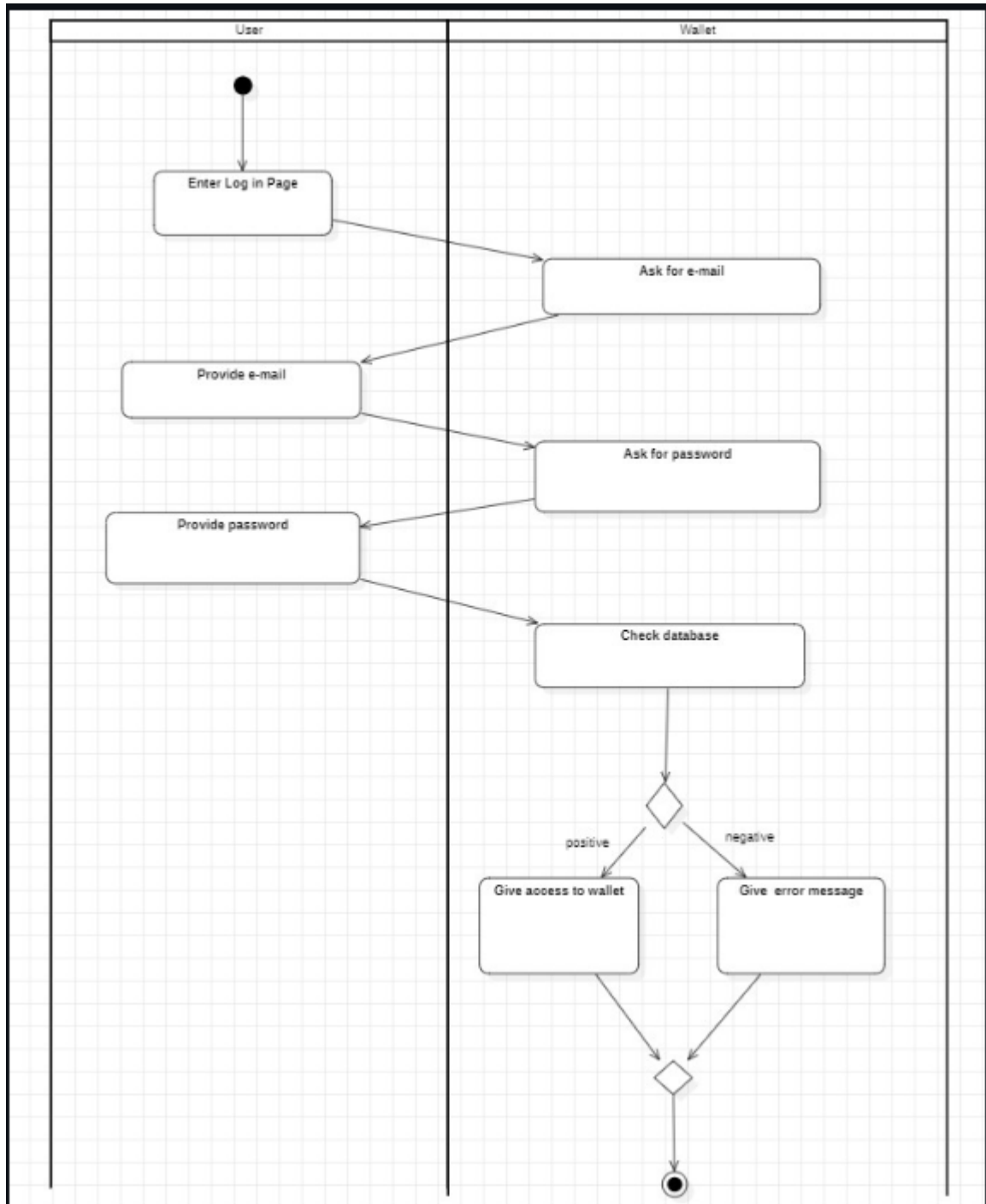
3.4.1.2.1 LOG OUT ACTIVITY DIAGRAM
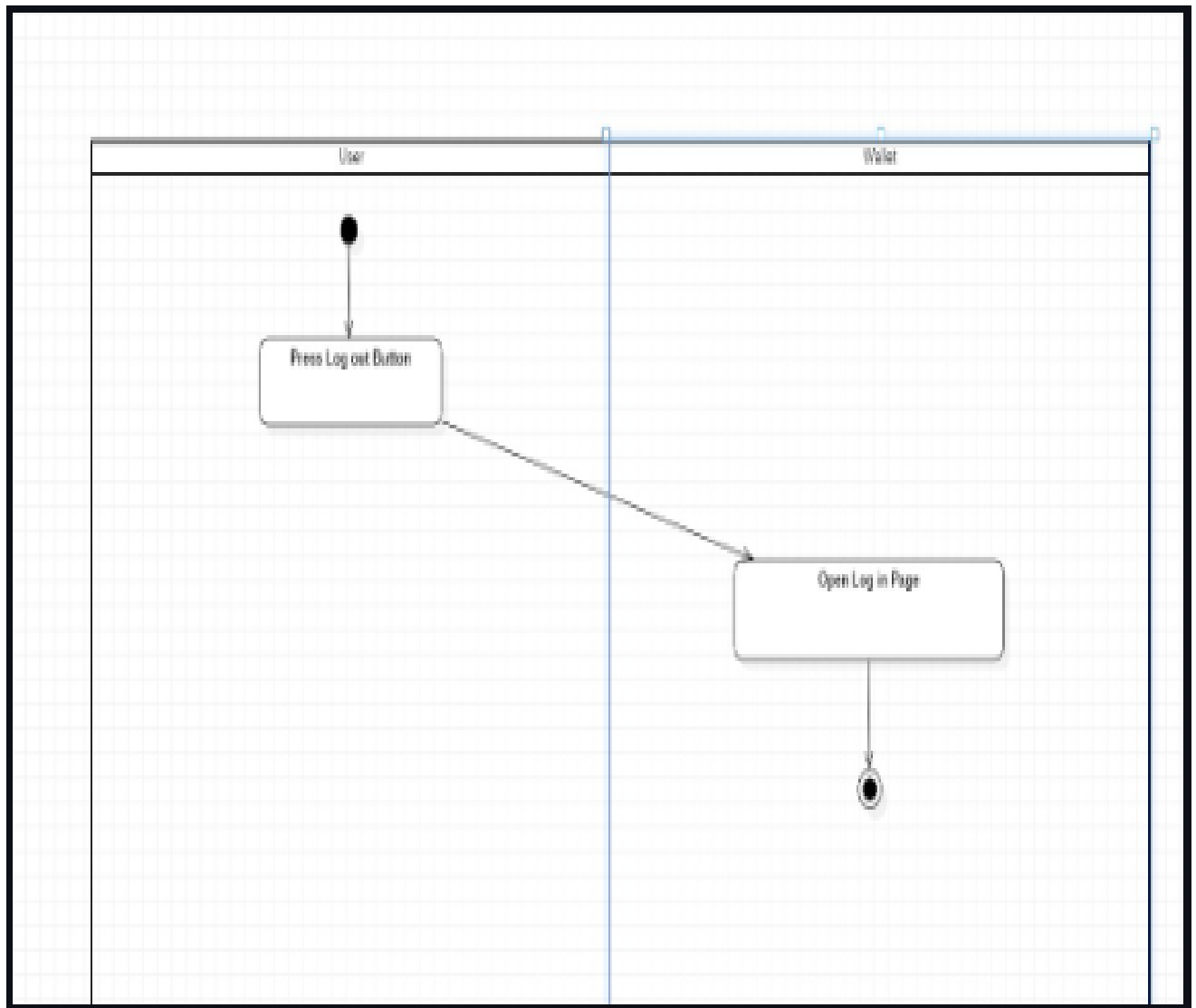
3.4.1.3. TRANSACTION ACTIVITY DIAGRAM
3.4.1.3.1 BUYING ACTIVITY DIAGRAM
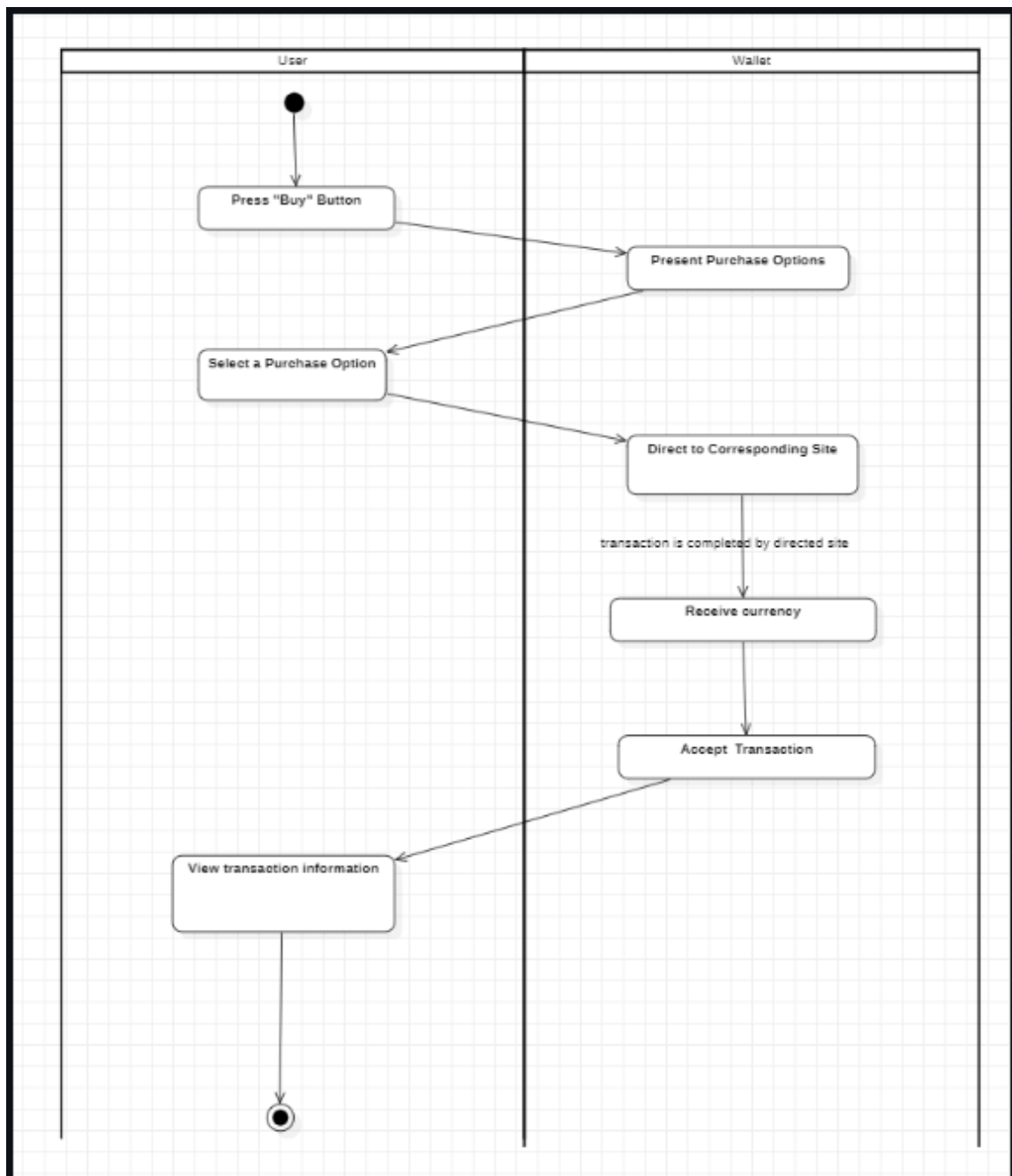
3.4.1.3.2 SENDING ACTIVITY DIAGRAM
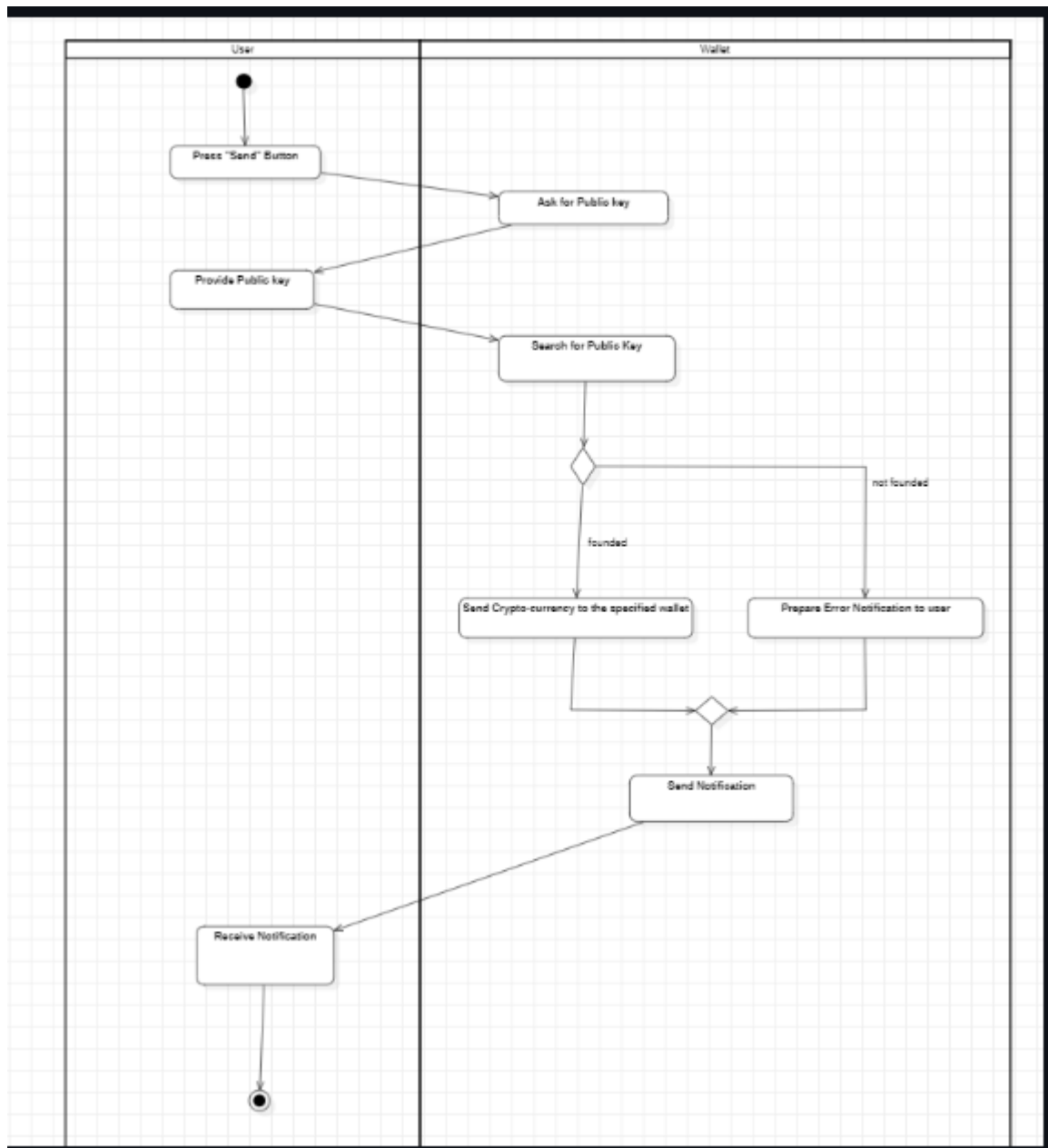
3.4.2 SEQUENCE DIAGRAMS

3.4.2.1. REGISTER SEQUENCE DIAGRAM
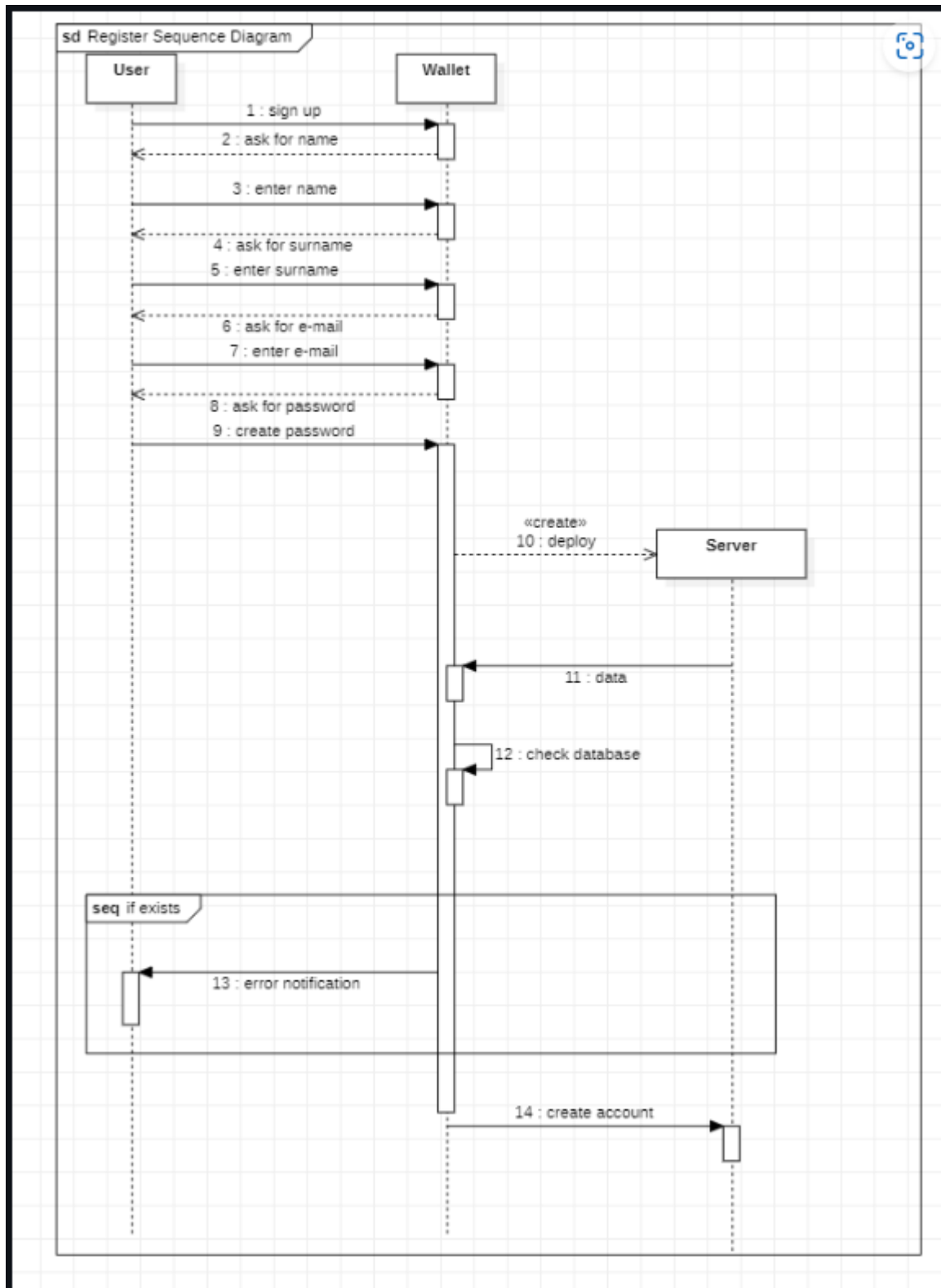
3.4.2.2. LOG IN & LOG OUT SEQUENCE DIAGRAMS

3.4.2.2.1 LOG IN SEQUENCE DIAGRAM
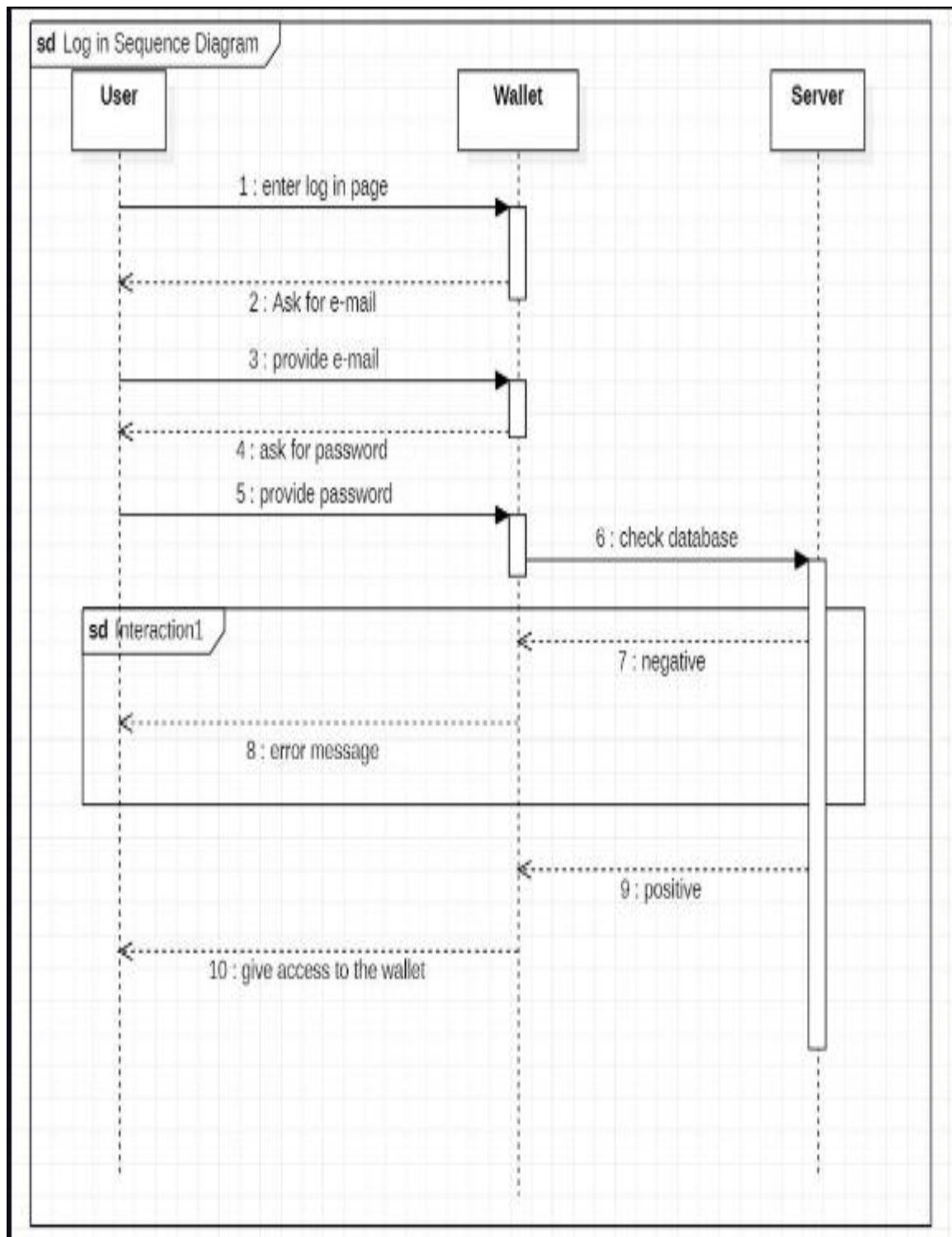
3.4.2.2.2 LOG OUT SEQUENCE DIAGRAM
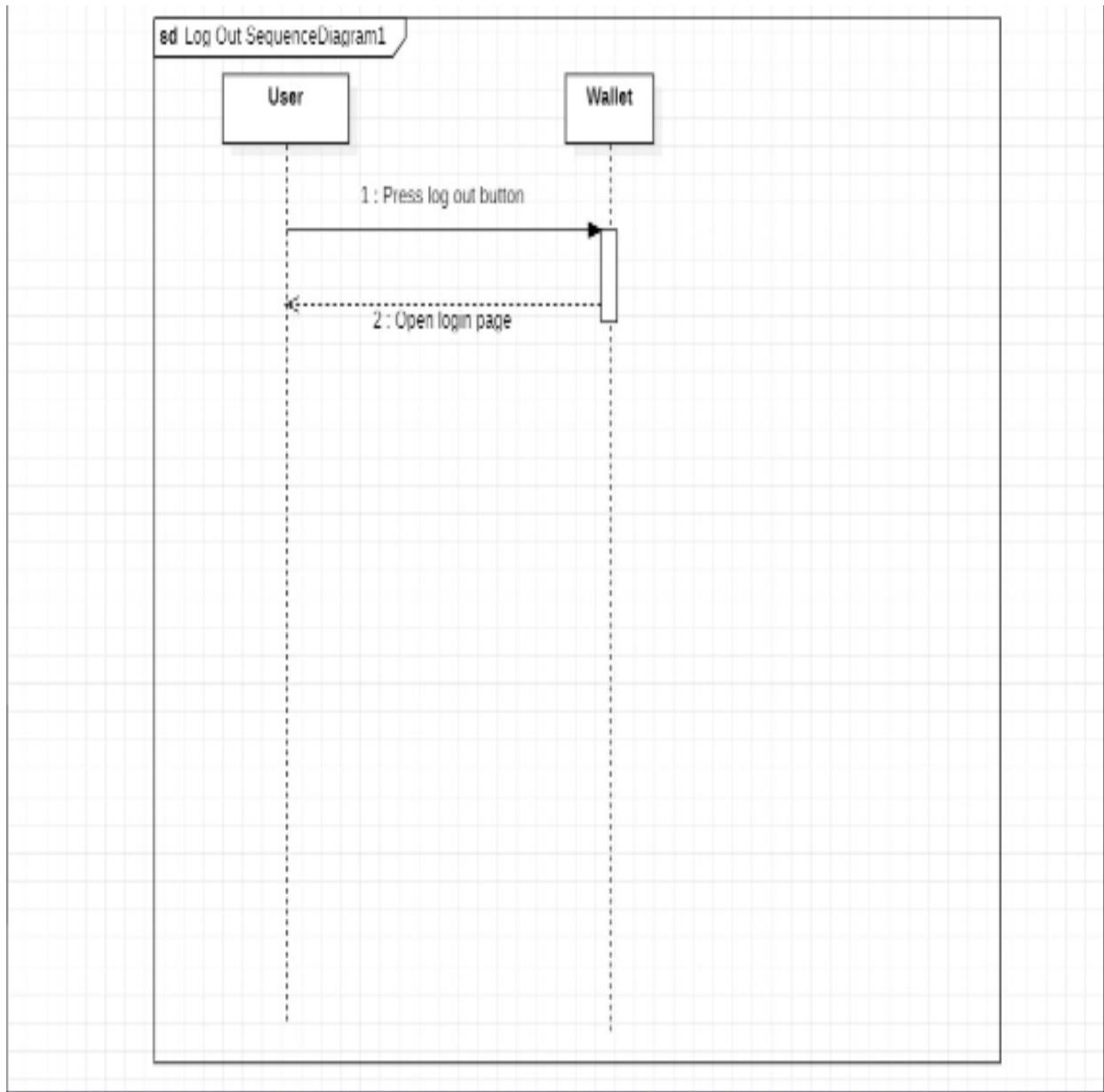
3.4.2.3. TRANSACTION SEQUENCE DIAGRAM
3.4.2.3.1. SEND SEQUENCE DIAGRAM

3.4.2.3.2. BUY SEQUENCE DIAGRAM

sd Transaction Buy Sequence Diagram

| User | Wallet | External source |

1 : press buy button

2 : Present purchase options

3 : select_option

4 : directs to site

5 : transaction

6 : receive currency

7 : print_transaction_information
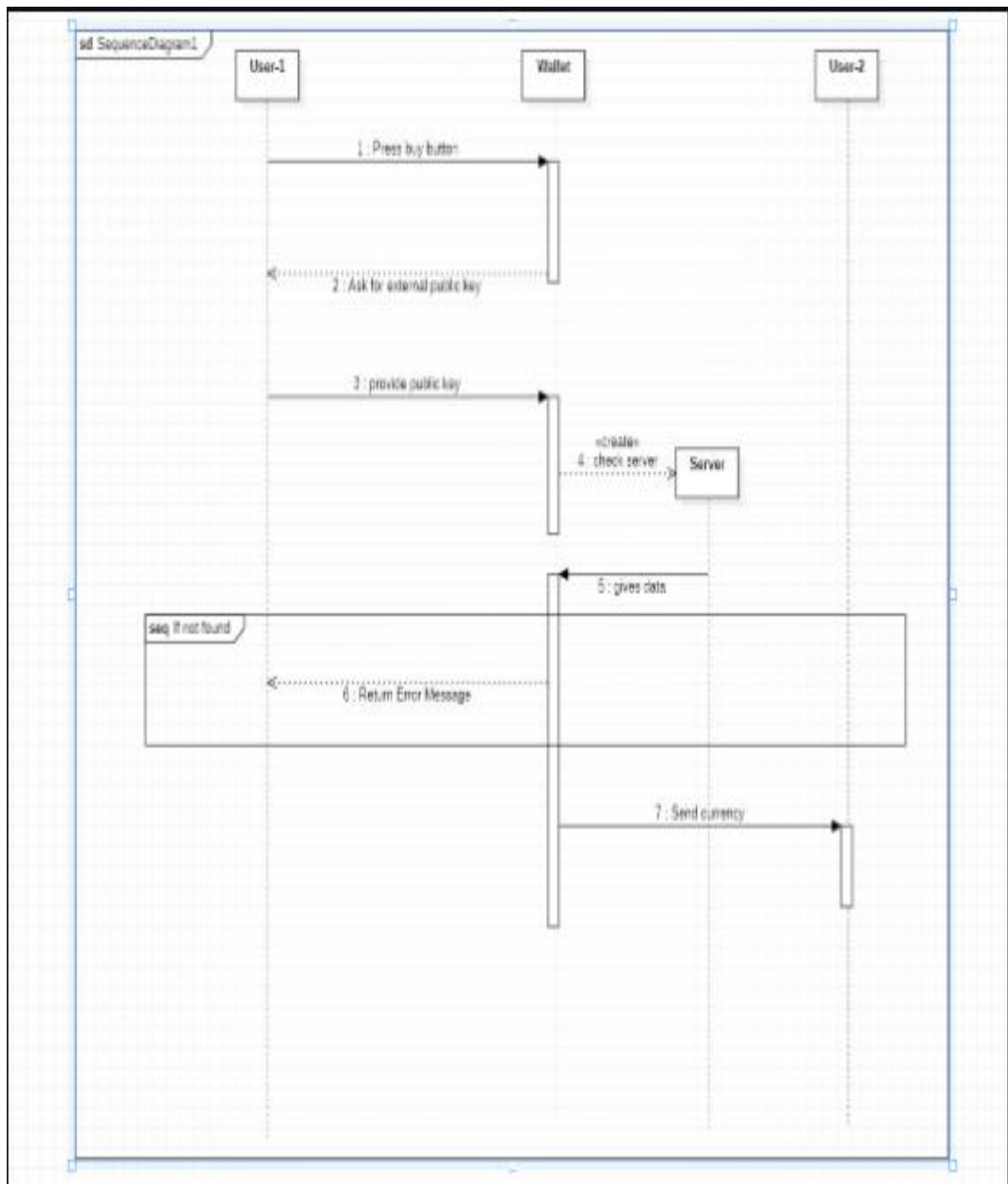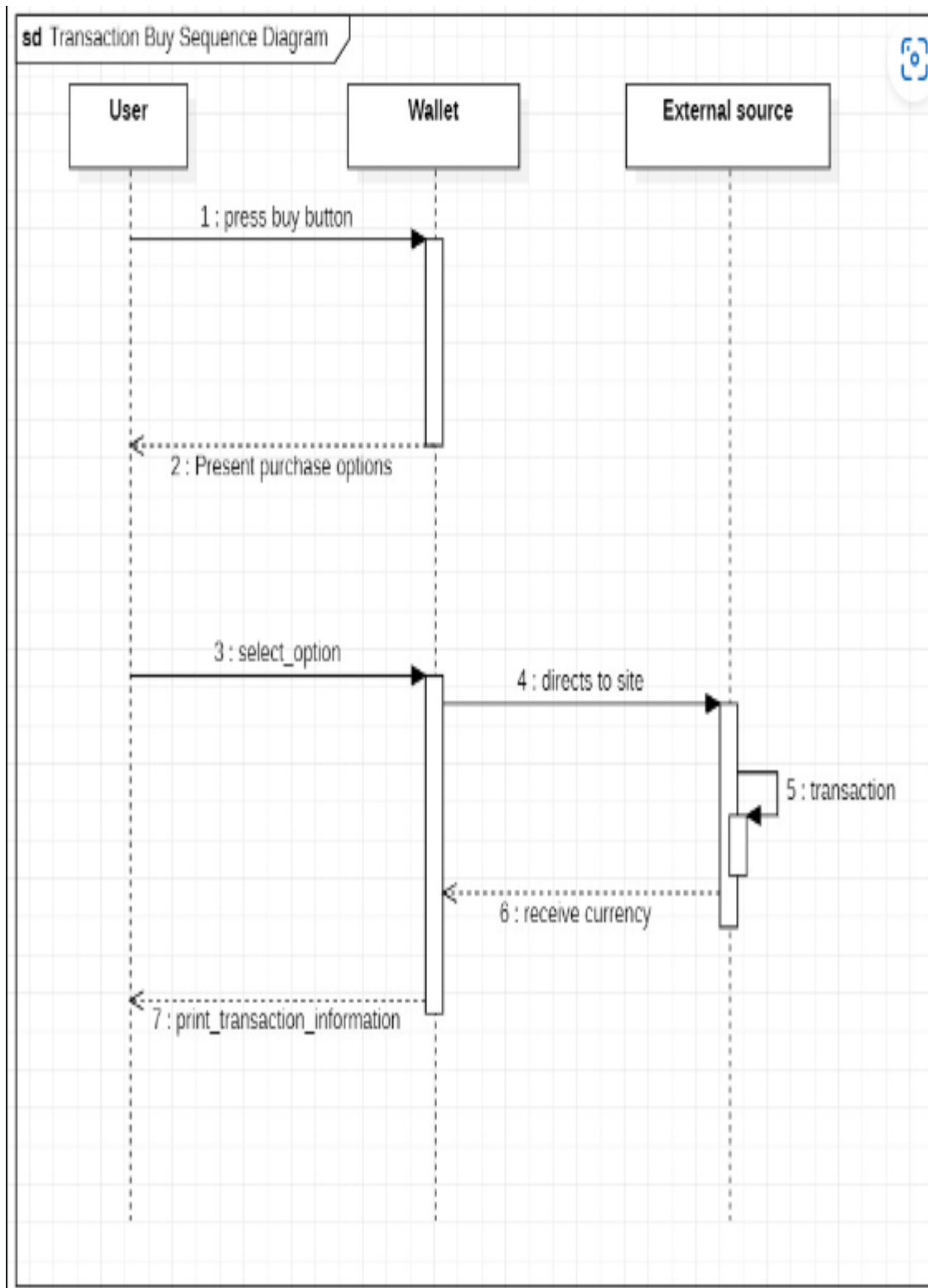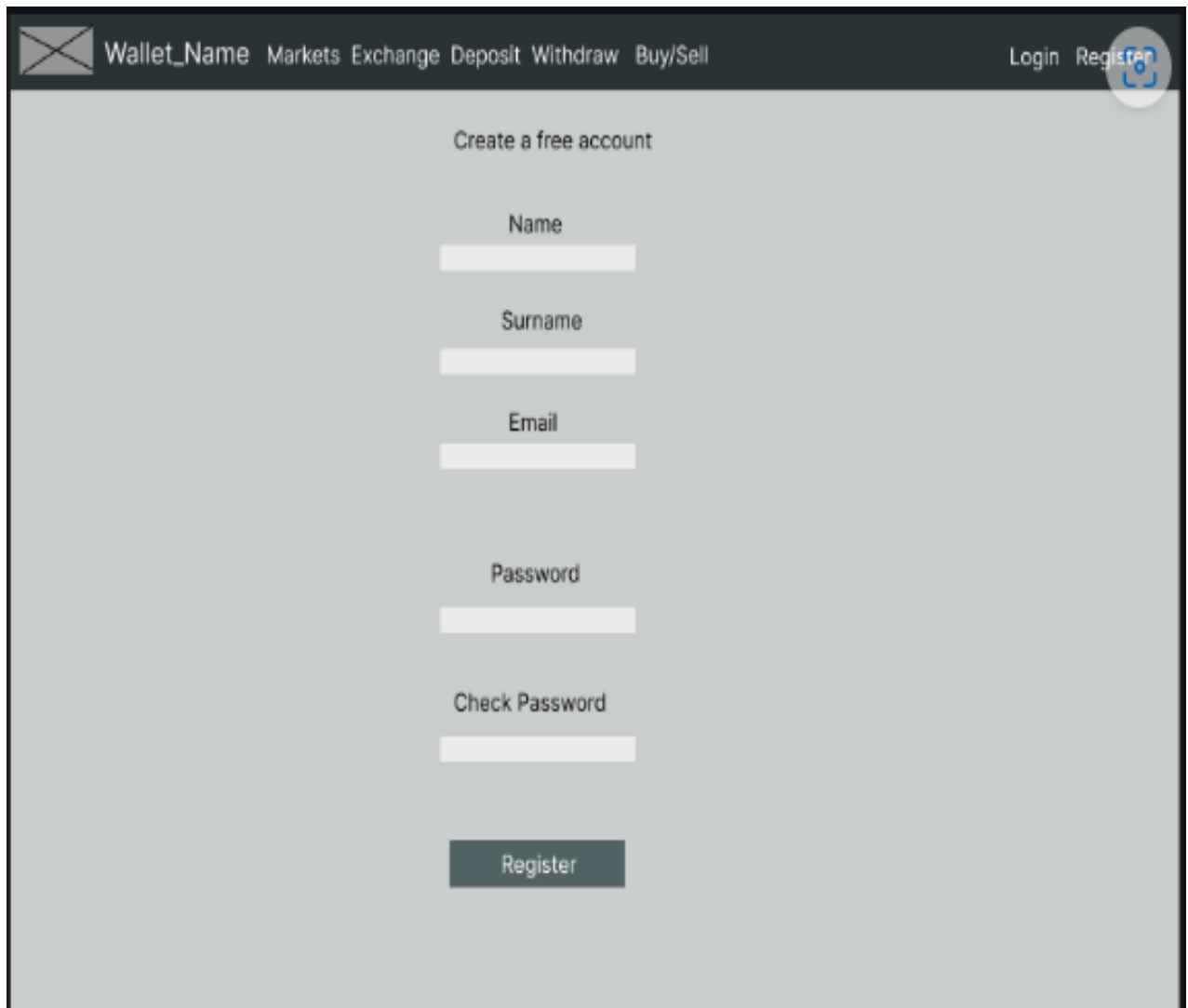
3.5.User Interface (UI) Design

We designed sample User Interfaces for the key concepts of our web application. These UI pages are just to give an idea about how our web page operates within itself, as a result, these sample designs do not represent our final product.

3.5.1. Home Page
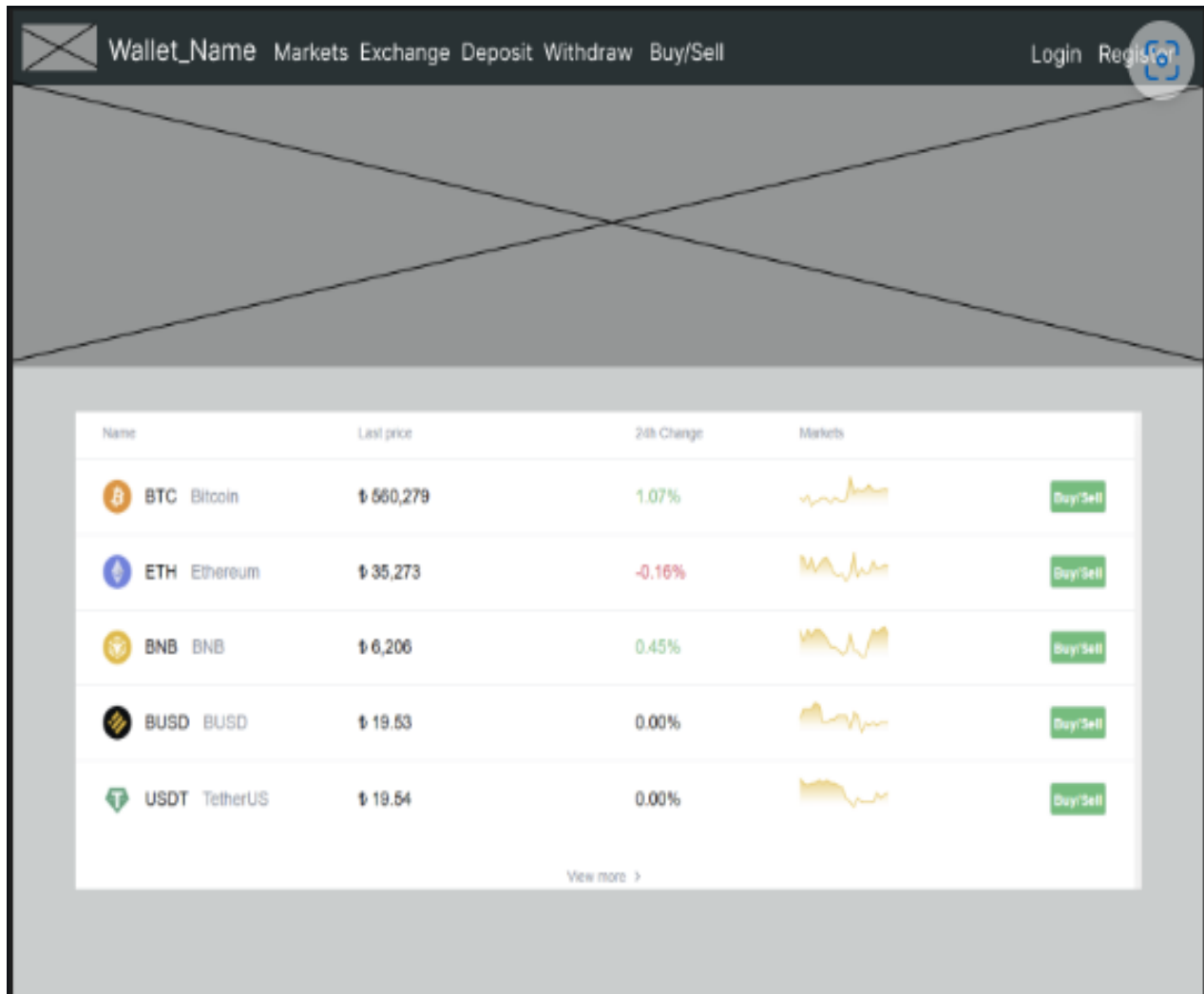
3.5.2. Register Page

Wallet_Name   Markets Exchange Deposit Withdraw Buy/Sell   Login   Register

Create a free account

Name

Surname
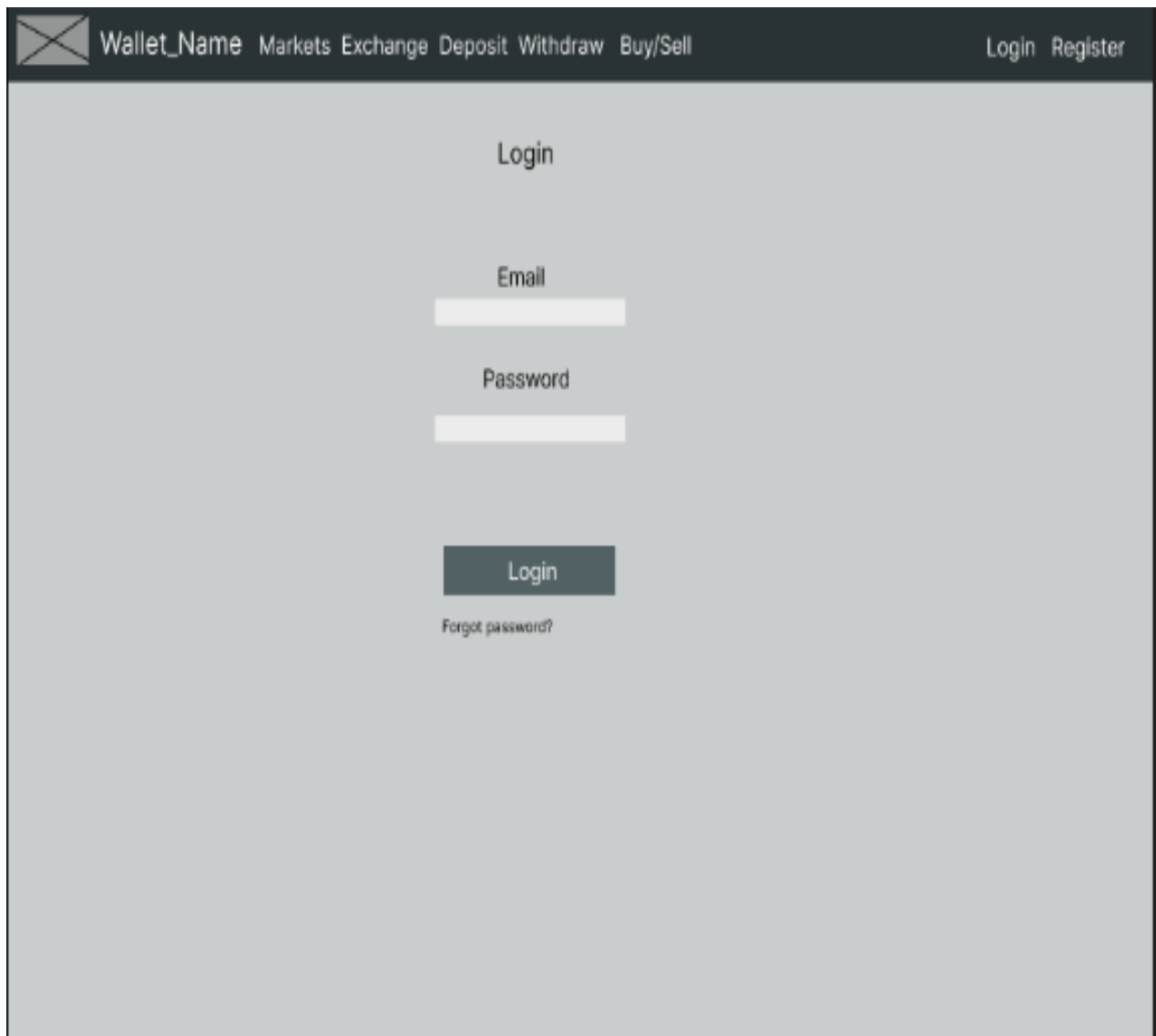
Email

Password

Check Password

Register

3.5.3. Login Page

Wallet_Name Markets Exchange Deposit Withdraw Buy/Sell   Login Register

Login

Email

Password

Login

Forgot password?

3.5.4. Wallet Page
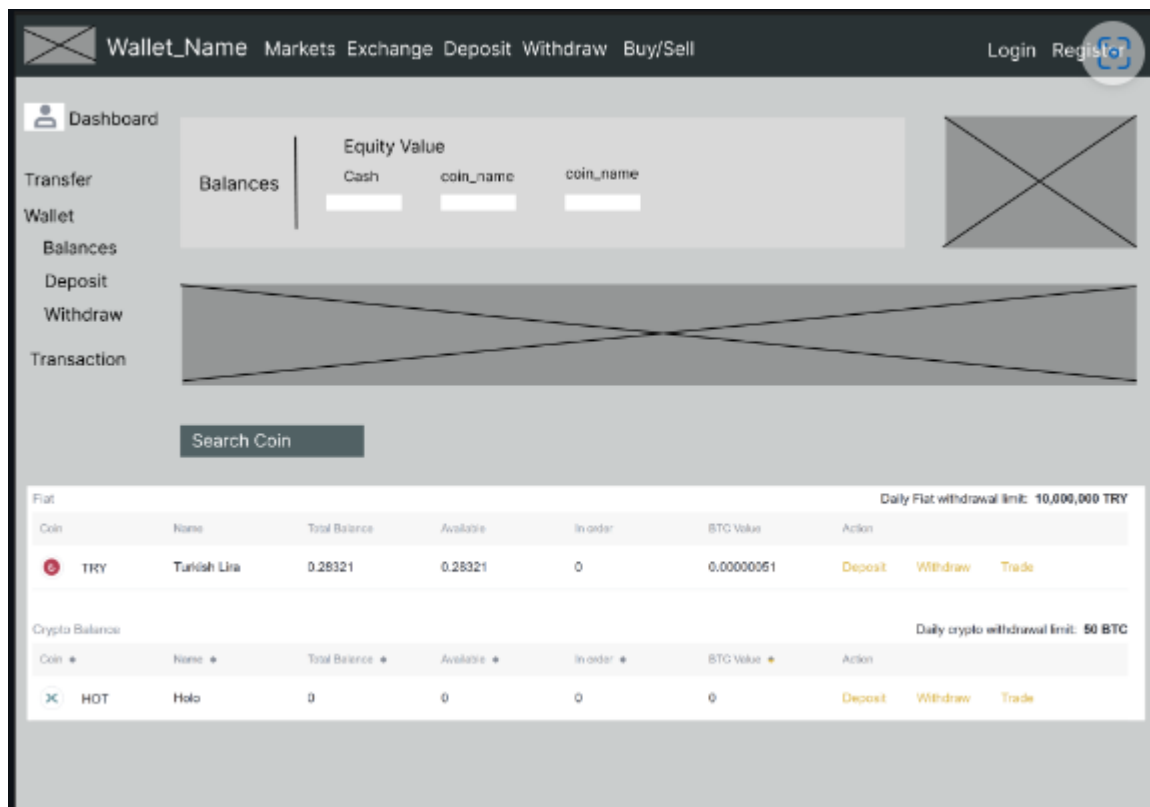
4. Software Requirements Specification (SRS)

4.1. INTRODUCTION

4.1.1. Purpose

This document contains information about creating a new Crypto currency, A Crypto wallet web application, and NFTs. This project includes information about the fundamentals of how blockchains and cryptocurrencies work and how these new technologies are developed. This document provides detailed information about the requirements of the project. It reflects the identified constraints and proposed software functionalities. Moreover, the SRS document explains how participants interact with the crypto wallet.

4.1.2. Scope of Project

Crypto currency is just like a regular currency (a unit of storage, account, and a means of exchange) but in a digital platform and accepted universally. Cryptocurrencies do not have a central issuing or regulating authority, instead using a decentralized system (Web 3.0) to record transactions and issue new units. Cryptocurrencies run on a distributed public ledger called blockchain, a

record of all transactions updated and held by currency holders.

A Crypto-currency wallet is where you keep your private keys. It could be a dedicated device (hardware wallet), an app on your computer or smartphone, or even a piece of paper. Most users will rely on wallets to interact with a cryptocurrency network. Different types will provide varying levels of functionality, and a paper wallet cannot sign transactions or display current currency prices.

NFTs are tokens that we can use to represent ownership of unique items. NFT stands for non-fungible token. Non-fungible is an economic term that you could use to describe things. These things are not interchangeable with other items because they have unique properties.

4.1.3. Glossary

TERM	DEFINITION
Blockchain	Blockchain is a method of recording information that makes it impossible or difficult for the system to be changed, hacked, or manipulated.
Web 3.0	The third generation of the internet focused on decentralization and semantic learning.
Cyrpto-Currency	A Cryptocurrency is just like a normal currency(a unit of storage and account and a means of exchange) but in a digital platform and accepted universally.
Cyrpto Wallet	A cryptocurrency wallet is an account with software, hardware, and the owner's private key that may be used to purchase, sell, and (in most cases) sign transactions for the NFTs that were introduced to the world with the first cryptocurrency, Bitcoin.
Hot Wallet	Hot wallets are cryptocurrency wallets that are connected to the internet.
Non-Fungible Tokens (NFT's)	NFTs are digital assets and a unit of data stored on the blockchain that are not interchangeable because they are unique.

4.2. OVERALL DESCRIPTION

4.2.1. Product Perspective

A digital currency that enables people to transfer value via the internet. The 3 major aspects of this project will proceed crypto-currency, crypto wallets, and NFT's. The basic idea behind crypto currencies is to create a secure financial system that allows for decentralized transactions (blockchain). Crypto-currency wallets offer a simple interface for managing users' crypto balances and storing public and private keys. They also support blockchain-based cryptocurrency transfers. An immutable token (NFT) is a type of blockchain cryptographic token that represents a unique asset. Because NFT's are not interchangeable, they can be used as digital proof of authenticity and ownership. The goal of this project is to grow it by focusing on blockchain, crypto currency, crypto wallet, and NFT in general.

4.2.2. Development Methodology

We intended to develop the project using agile methodology, which is an iterative development-based software development methodology. Agile methodology promotes continuous development and testing iteration throughout the software development process. Agile is a term used to describe development methodologies that involve group members participation, learning, and improvement. This method enables the group to cooperate quickly and efficiently. This increased focus is beneficial in minimizing the overall risks associated with software development. Given these steps, the agile method is the best fit for the project we are working on.

Agile Methodology Principles:

User satisfaction requires continuous software development.

Changing requirements must be implemented for the created product to maintain its competitive advantage.

Developers must collaborate throughout the project, and face-to-face communication is the most effective way to transfer knowledge.

The best product is generally produced by a group with enhanced organizational and communication skills.

4.3. Users Characteristic

4.3.1. Users

To use this website, users must have access to a computer, the internet, and a browser.

Users must first register with a valid e-mail address to access the website.

During registration, a valid password should also be created.

Users must know English.

4.3.2. Admin

Crypto wallets cannot have admins and crypto-currencies and NFT's cannot own any admins because they are not a website or a system.

4.4. REQUIREMENTS SPECIFICATION

4.4.1. External Interface Requirements

User interfaces

The user interface of the system (Crypto-Currency-Transaction and NFT Creation) is simple and easy to understand. The user interface will be any web browser for the crypto wallet. Additionally, our website is compatible with tablets and mobile phones running Android and iOS. For access to the system, a registration process will be required. Users also need to have access to the internet, a computer, an active e-mail address. Users can sign up for the system by establishing a strong password using information such as their names, last names, and e-mail addresses.

Hardware interfaces

As a web system, this system can be used on computers, mobile devices, and tablets. Our technology offers support for online video and audio. The hardware support for these is present on the system.

Software interfaces

Since the system will operate online, it supports all web browsers. For storing user data, NoSQL Mongo-database management systems are used. NoSQL, a database management technology, allows for rapid data management. Blockchain is an open-source computer program that is used to ensure system security. Crypto wallet, crypto token, and NFT were all constructed using the Solidity framework and MongoDB Compass or Atlas.

Communications interfaces

Because the many components of the system are dispersed, communication between them is crucial. However, the underlying web operating systems handle the system, therefore it doesn't matter how the connection is given. As a system communication interface, cameras are used.

4.4.2 Functional Requirements

Profile Management Use Case

Profile Management Use CaseUsers are only limited to open one account. Users have the ability to log in and out of the system.

- Users are only limited to open one account.
- Users have the ability to log in and out of the system.
- When users log in to the system, a confirmation code is received via message and e-mail.
- The last login information, the user ID assigned to the user, and the user's current assets are presented when the system is accessed.
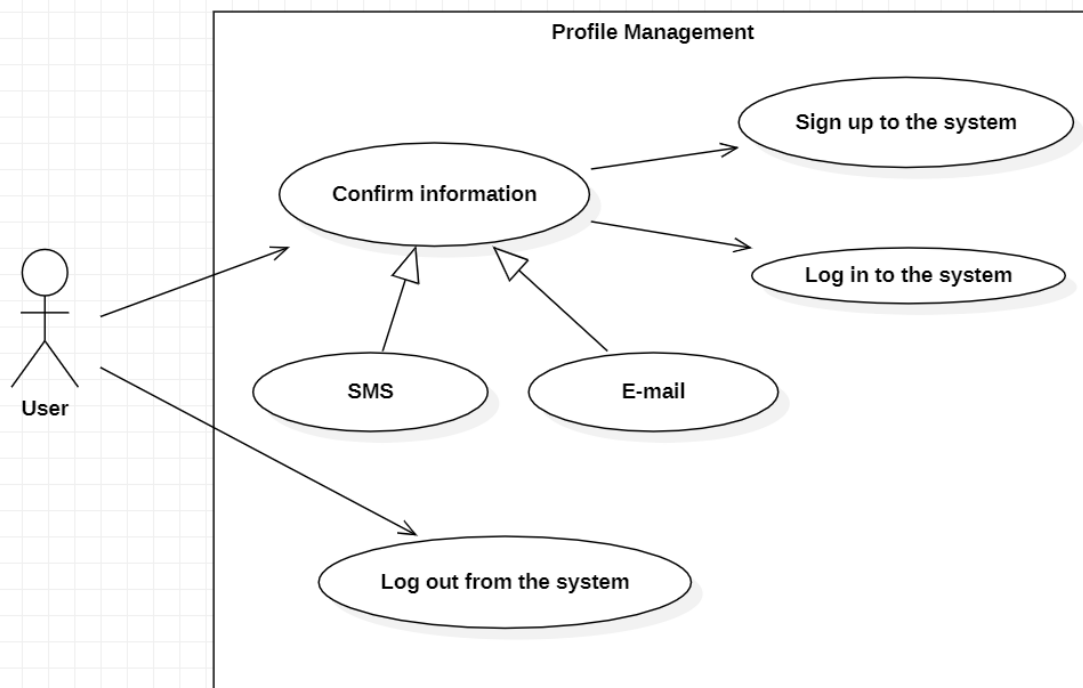
Users could change their password.
Users are given the right to delete their account.

- Users can set options such as currency and time zone from the options section.
- If a user wishes to change their password, confirmation via e-mail is required. The link in the e-mail is used to reset the password.

- For account security, when users log in from different devices, an e-mail notification is sent to the account owner. The devices section of the user account contains information such as location, device, time, and date.
- Users are given the right to delete their account.
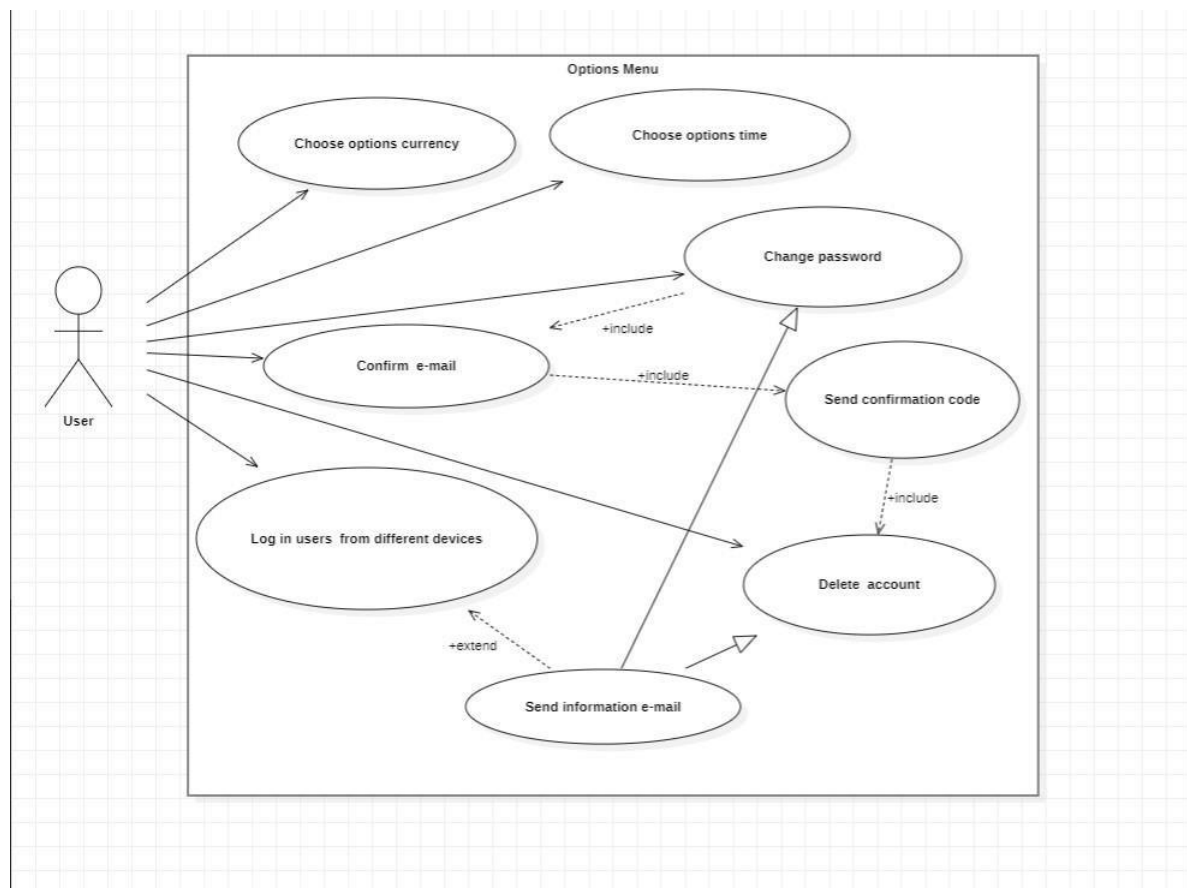
Sending Transaction Use Case Settings

Users can receive and send currencies from/to other crypto wallets.

To send currencies to another wallet, the user must own the public key of the other wallet.

User can choose the transaction amount.

Users can view transaction information one more time before accepting it if they want to.

External wallets can be either external crypto-currency wallets, external online money wallets or Testnet Faucets.

- Users can receive and send currencies (50 million $ per a day) from/to other crypto wallets.
- To send currencies to another wallet, the user must own the public key of the other wallet.
- User can choose the transaction amount (max limit is 50 million $).
- Users can view transaction information one more time before accepting it if they want to.
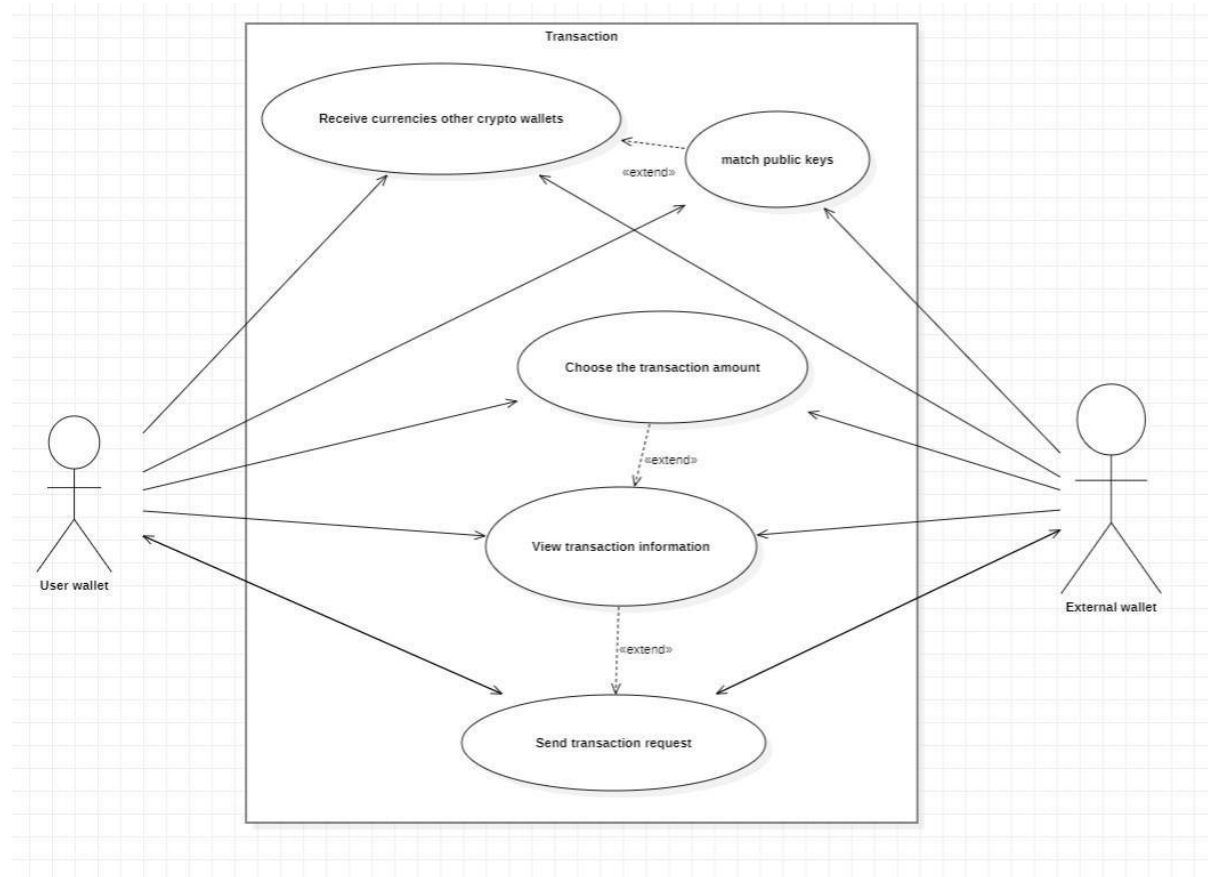
4.4.3 Software System attributes

Portability

- Our crypto-currency and NFTs will be accessible from any existing Ethereum wallets and Ethereum Blockchain, so no external portability requirements are required.
- Our Crypto wallet, on the other hand, will be accessible through Internet browsers such as Google Chrome, Safari, and Firefox.

Performance

- When user wants to access his/her private key(s), the system must inform user about how to protect their private key(s) and why private key is important.
- The system must show the user only the crypto wallet that they chose, if they have more than one wallet in their account, these wallets should not be visible unless they want to view them.
- If our user purchases more than one crypto currency from the same blockchain, the system must also show their balance from their wallets specified to the blockchain at hand.
- User can withdraw a limited amount (50 million $ per a day) of currency.

Usability

The system sends user verification code before any purchases of crypto currencies.

Safety Requirement

The system must protect user data, and keys, both public and private (blockchain).

4.4.5 Data Flow Diagrams

4.4.5.1 Context Diagram
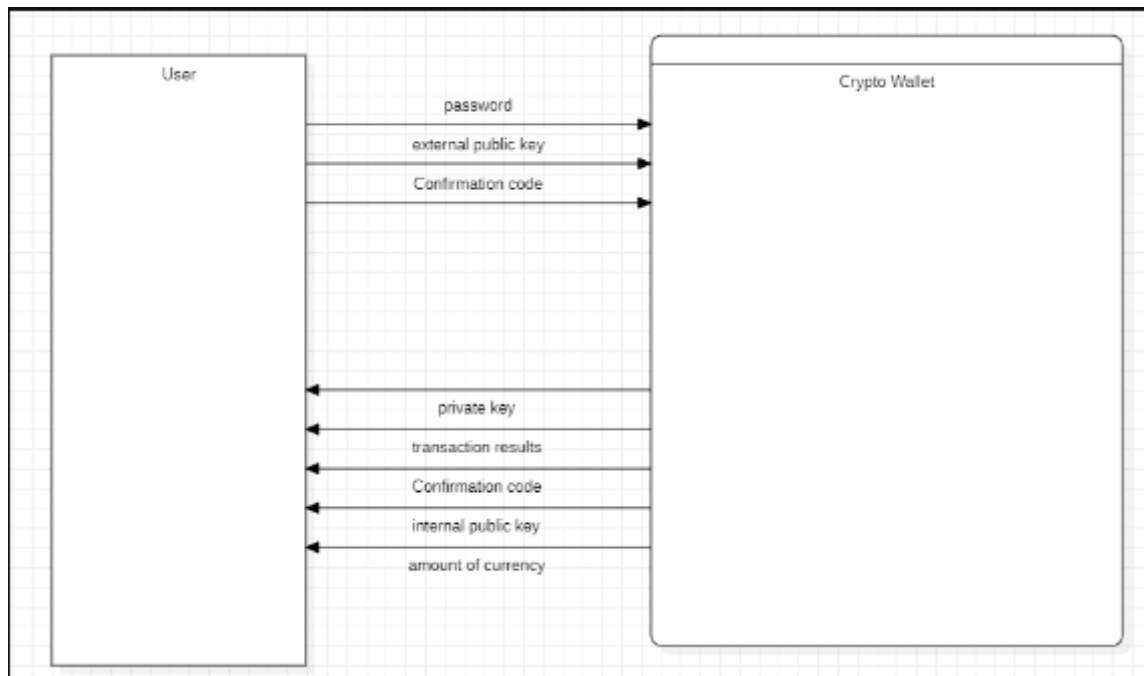
1.Introduction

1.1 Version Control

Version Number	Description of Changes	Date
1.0	First Version	March 2023

1.2 Overview

The usage status of Crypto-currency wallet users specified in the SRS document will be tested.

1.3 Scope

This document encapsulates the test plan of the use cases, test design specifications and the test cases correspond to test plan.

2. Features to Be Tested

Each of the significant aspects that will be tested is listed below along with a brief description. A Test Design Specification will be added for each significant feature.

3.Test Design Specifications

3.1 Test for User Interface

3.1.1 Register Page

Each user must have a name, surname and e-mail address in order to register in the system. Then, it ought to generate a reliable password.

ID	3.1.1
Purpose	Register into the system.
Requirements	A valid e-mail address.
Priority	Medium
Estimated Time Needed	5 min
Dependencey	A valid user account.
Procedure	Enter valid name-surname, e-mail and password.

3.1.2 Login Page

To access the system, an e-mail address and password are required.

ID	3.1.2
Purpose	Login to the system.
Requirements	-
Priority	Medium
Estimated Time Needed	1 min
Dependencey	User account must exist.
Procedure	Enter valid and matched e-mail and password.

3.1.3 Forgot Password

It is decided on a password of at least 8 characters, one uppercase, one lowercase, at least one symbol, and at least one number. The forgotten password button must be pushed, the system's registered e-mail address must be filled again, and the reset password button must be pressed. Then click the e-mail's provided link.

ID	3.1.3
Purpose	Reset password.
Requirements	-
Priority	Low
Estimated Time Needed	3 min
Dependencey	E-mail entered by user must exist and valid.
Procedure	User will fill e-mail part and click reset password button.

3.1.4 Change Password

It is decided on a password of at least 8 characters, one uppercase, one lowercase, at least one symbol, and at least one number. A confirmation link must be clicked on the system-entered e-mail address before the password may indeed be changed.

ID	3.1.4
Purpose	Change password.
Requirements	-
Priority	Low
Estimated Time Needed	3 min
Dependencey	Login to the system and press profile page.Then choose password sub page and fill current password.
Procedure	User will fill current password part and create a new password.Then user must confirm new password and click update password button.

3.2 Test for Wallet Transactions

3.2.1 Transaction

A valid MetaMask wallet address and enough gas price (test networks get different prices and test tokens) to token transfer are required to have to be successful.

ID	3.2.1
Purpose	Token Transaction .
Requirements	An wallet address transfer to.
Priority	High
Estimated Time Needed	3-5 min
Dependencey	Login to the system and connect to MetaMask wallet account.
Procedure	User connects to a valid MetaMask wallet account.Then user must provide another wallet address for transfer and amount of token.

3.2.2 Transaction History

All transfers made are recorded as day, hour, token value and sender-receiver account.

ID	3.2.2
Purpose	To view latest transactions.
Requirements	-
Priority	Medium
Estimated Time Needed	1 min
Dependencey	Login to the system.
Procedure	User slides transaction pages and reaches latest transactions.

User Manual
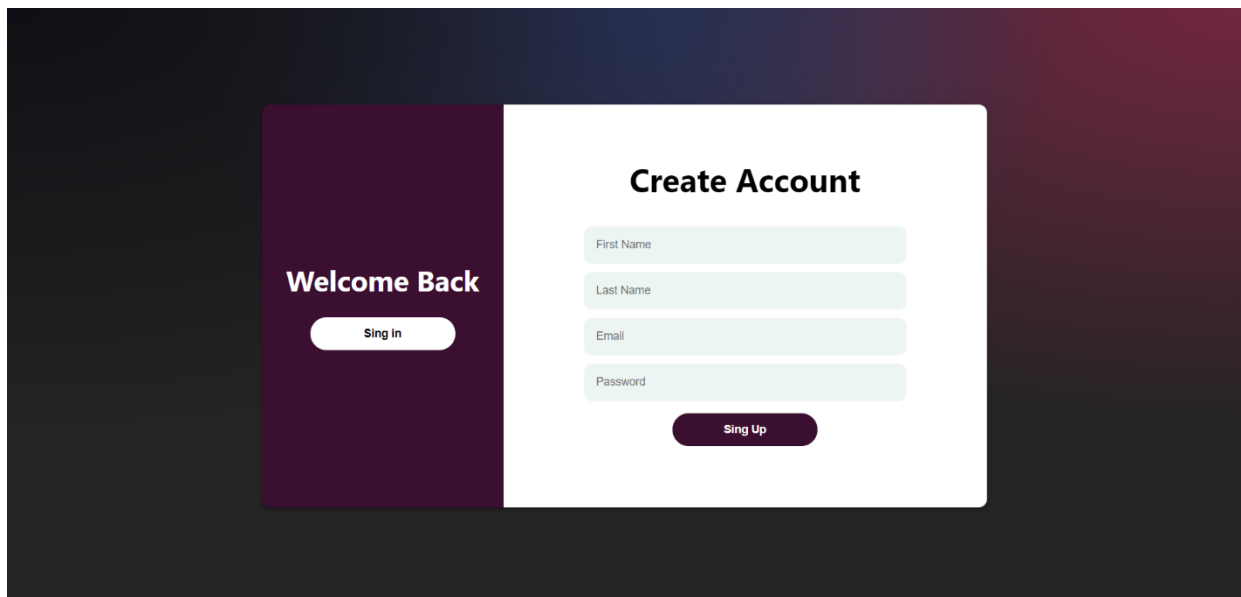
Login/Register Page

This page displays the wallet's registration and login pages.

Login Page
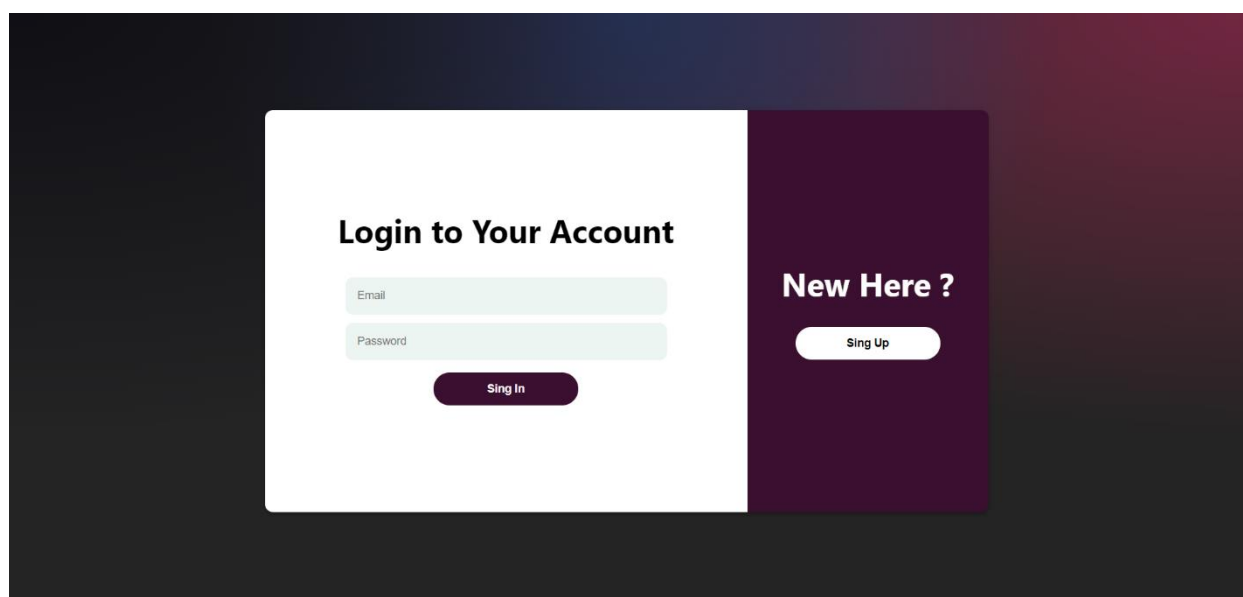
Register Page
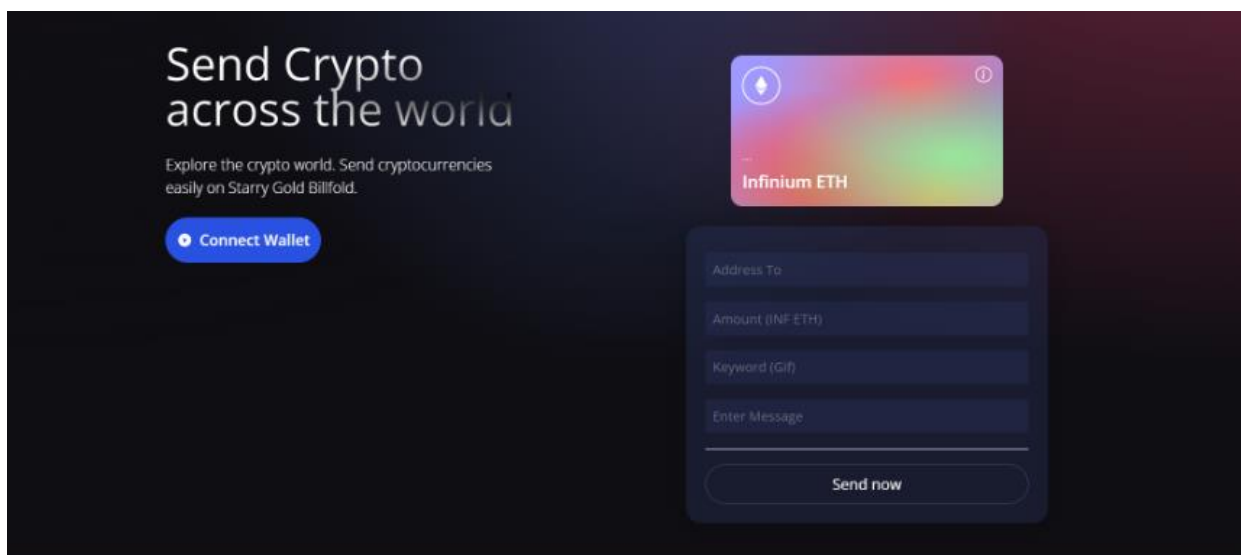
Transaction Page

This page allows you to transmit tokens by linking to your MetaMask account address.

Transaction Page-1

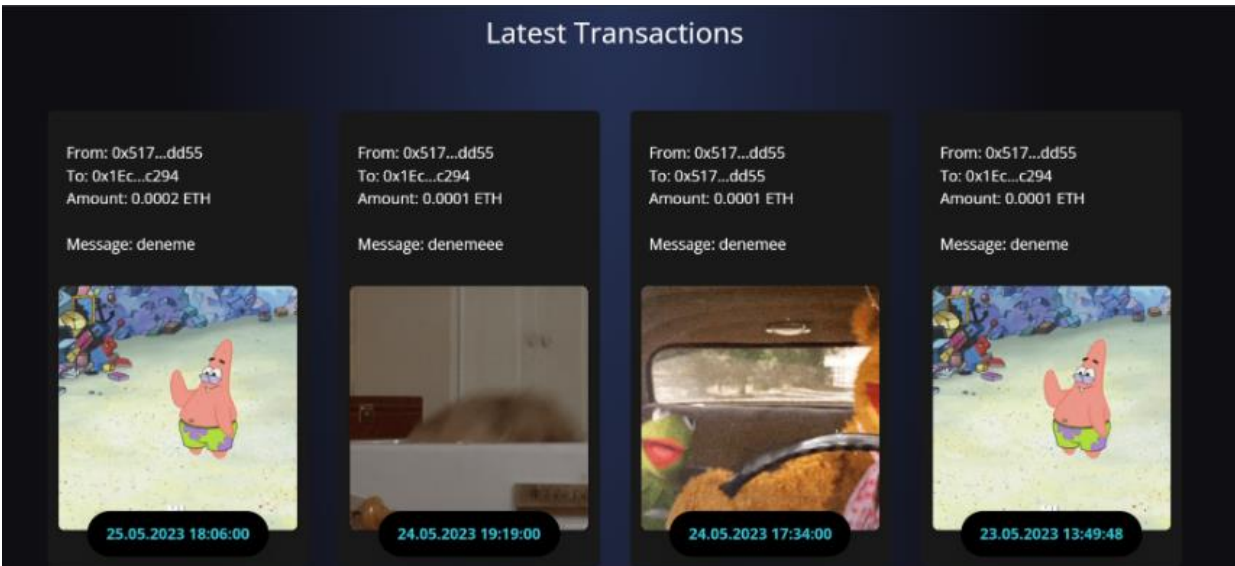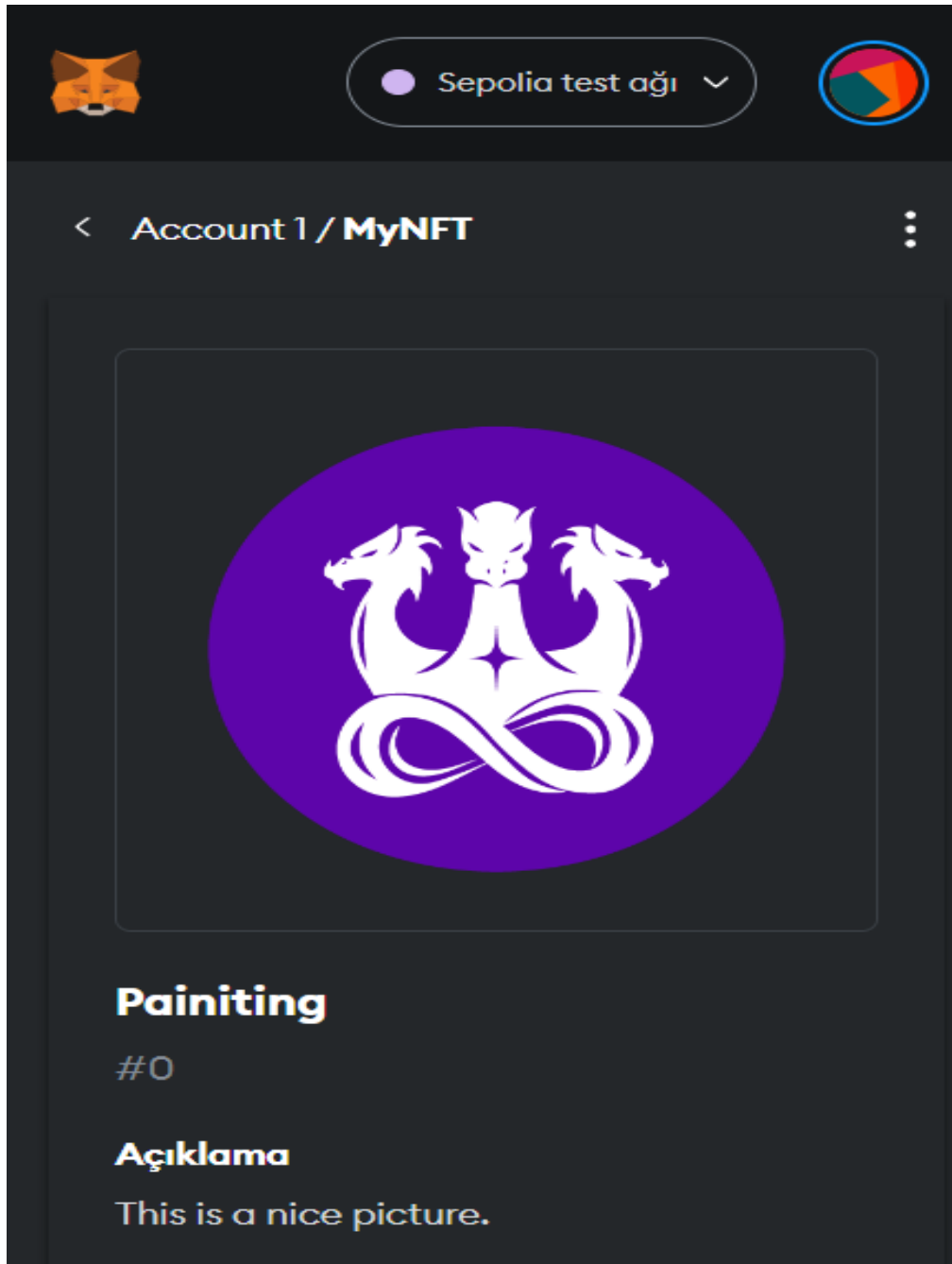## All Transactions

This page displays token transfers done using the Starry Gold Billfold wallet, including the address, token amount, and time sent.

Latest Transactions

NFT

NFT generated via MetaMask on this page.

REFERENCES

- https://github.com/CankayaUniversity/ceng-407-408-2021-2022-Cryptocurrency-Portfolio-Tracker/wiki/Literature-Review,Abstract,1-24

- ARGHANDABI, H. (2021). Yeni kripto para geliştirme yöntemi (M.S. thesis). ISTANBUL AYDIN UNIVERSITY.

- https://www.allianz.com.tr/tr_TR/seninle-guzel/nft-nedir.html

- Bitcoin: A Peer-to-Peer Electronic Cash System, Satoshi Nakamoto

- HISTORY OF CRYPTOCURRENCIES (HOW EVERYTHING STARTED)

- Ethereum - Wikipedia

- Crypto Tokens - Wikipedia

- Fundamentals of creating a new cryptocurrency using blockchain technology,45

- ceng-407-408-2018-2019-Mobile-Assistant-for-Cryptocurrency-Markets/Literature-Review

- https://tr.wikipedia.org/wiki/Tether_(kripto_para_birimi)

- [https://www.fool.com/investing/stock-market/market-sectors/financials/cryptocurrency-stocks/types-of-cryptocurrencies/

- https://www.artopol.com/sayfa/nedir-bu-nft

- https://www.ledger.com/tr/academy/nfts/nftlerin-guvenligi-nasil-saglanir

- https://en.wikipedia.org/wiki/Non-fungible_token

- https://academy.binance.com/en/articles/who-is-nft-artist-beeple- and-why-is-he-famous/

- https://www.simplilearn.com/tutorials/blockchain-tutorial/what-is- nft

- https://cointelegraph.com/blockchain-for-beginners/a-step-by-step-beginners-guide-to-creating-your-first-cryptocurrency-token/amp

- https://www.nerdwallet.com/article/investing/cryptocurrency

- https://www.simplilearn.com/tutorials/blockchain-tutorial/blockchain-technology#what_is_blockchain_technology

- https://ethereum.org/en/nft/

- https://www.kaspersky.com/resource-center/definitions/what-is-cryptocurrency

- https://www.datadriveninvestor.com/2019/09/10/will-cryptos-replace-fiat-currencies-in-the-long-run/

- https://tr.wikipedia.org/wiki/Kripto_para_c%C3%BCzdan%C4%B1

- https://opensea.io/learn/what-is-crypto-wallet

- https://shiftdelete.net/kripto-parada-sicak-ve-soguk-cuzdan-nedir

- https://opensea.io/learn/what-is-crypto-wallet

- https://www.coindesk.com/learn/custodial-wallets-vs-non-custodial-crypto-wallets/

- https://en.wikipedia.org/wiki/Solidity

- https://www.guru99.com/agile-scrum-extreme-testing.html

- https://lucidspark.com/blog/what-is-agile-methodology

- Nethereum. (n.d.). Nethereum. Retrieved January 3, 2023, from https://nethereum.com/

- Mongo DB Documentations. (n.d.). https://www.mongodb.com/docs/

- ARGHANDABI, H. (2021). New cryptocurrency development method (M.S. thesis). ISTANBUL AYDIN UNIVERSITY.

- https://www.allianz.com.tr/tr_TR/seni nle-guzel/nft-nedir.html

- Bitcoin: A Peer-to-Peer Electronic Cash System by Satoshi Nakamoto

- HISTORY OF CRYPTOCURRENCIES (HOW EVERYTHING STARTED)

- Ethereum - Wikipedia

- Crypto Tokens - Wikipedia

- Fundamentals of creating a new cryptocurrency using blockchain technology,45

- What makes crypto so important and should I care

- ceng-407-408-2018-2019-Mobile-Assistant-for-Cryptocurrency-Markets/Literature-Review

- https://en.wikipedia.org/wiki/Tether_(crypto_currency)

- https://www.fool.com/investing/stock-market/market-sectors/financials/cryptocurrency-stocks/types-of-cryptocurrencies/

- https://www.artopol.com/page/nedir-bu-nft

- https://www.ledger.com/tr/academy/n fts/nftlerin-guvenligi-nasil-saglanir

- https://en.wikipedia.org/wiki/Non-fungible_token

- https://academy.binance.com/en/articles/who-is-nft-artist-beeple-and-why-is-he-famous/

- https://www.simplilearn.com/tutorials/blockchain-tutorial/what-is-nft

- https://cointelegraph.com/blockchain-for-beginners/a-step-by-step-beginners-guide-to-creating-your-first-cryptocurrency-token/amp

- https://www.nerdwallet.com/article/investing/cryptocurrency

- https://www.simplilearn.com/tutorials/blockchain-tutorial/blockchain-technology#what_is_blockchain_technology

- https://ethereum.org/en/nft/

- https://www.kaspersky.com/resource-center/definitions/what-is-cryptocurrency

- https://www.datadriveninvestor.com/2019/09/10/will-cryptos-replace-fiat-currencies-in-the-long-run/

- https://en.wikipedia.org/wiki/Kripto_para_c%C3%BCzdan%C4%B1

- https://opensea.io/learn/what-is-crypto-wallet

- https://shiftdelete.net/kripto-parada-sicak-ve-soguk-cuzdan-nedir

- https://opensea.io/learn/what-is-crypto-wallet

- https://www.coindesk.com/learn/custodial-wallets-vs-non-custodial-crypto-wallets/

- Nethereum. (n.d.). nethereum Retrieved January 3, 2023, from https://nethereum.com/

- Mongo DB Documentation. (n.d.). https://www.mongodb.com/docs/

- https://en.wikipedia.org/wiki/Solidity

- https://www.guru99.com/agile-scrum-extreme-testing.html

- https://lucidspark.com/blog/what-is-agile-methodog