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Design and Implementation of a Cloud Based Decentralized Cryptocurrency Transaction Platform

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ABSTRACTS

Trading in the crypto-currency market has seen rapid growth and adoption, as well as the interest in crypto related technologies like blockchain and smart contracts. Smart contracts have gained popularity in building so called Decentralized Applications (dApps) and Decentralized Finance (DeFi) apps, mainly because they are more secure, trustworthy, and largely distributed (removes centralized control). DeFi applications run on the blockchain technology and are secured by blocks (nodes) connected by cryptographical hash links. DeFi applications have a great potential in the crypto-currency trading domain, providing more secure and reliable means of trading, and performing transactions with crypto-currencies. Only verified transactions are added to the blockchain after being approved by miners through a consensus mechanism and then it is replicated (distributed) among the nodes on the blockchain network. This research paper proposes a DeFi Crypto Exchange by integrating a numerous-signature stamp with a crypto API. A numerous-signature stamp solves the issue of transaction verifiability and authenticity. A crypto API provides the data about each crypto currency with which trades and transactions will be performed. This paper also discusses the technical background of the technology and a few related works. Decentralization of transactions through smart contracts on the blockchain will improve trust, security and reliability of transactions and trades.

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1. INTRODUCTION

A defining feature of cryptocurrencies is that they are generally not issued by any central authority, rendering them theoretically immune to government interference or manipulation. The Ghana cedis is a one of many currencies that are backed by the US dollars however due to imminent economic decline, the cedi value has depreciated considerably prior to its inception. The value of the Ghana cedis (like any other fiat currencies) has a positive correlation with the trust of the people in their government and financial system so deductively if the people's trust dips dramatically; it could lead to hyperinflation of the cedi. To cite a common example, the Zimbabwean dollar due to hyperinflation made their currencies more worthless than the paper they were printed on (Toby, 2021). states that the African continent being the prominent user of mobile cash transactions has made advancement in modernization of finance system. Mobile Money transaction boomed globally in 2020, especially in sub-Saharan Africa which accounted for 43% of all new accounts, according to the GSM Association. More than half of such accounts are in Africa, which has been the fastest-growing region for mobile phone growth for several years. However, the security of such a system is flawed in a few ways making it the scavenging grounds of fraudsters. The use of just a mobile phone and sim card being the innovation for its convenience is also the perpetuator of exploitation. If the sim cards can be easily identified and targeted, there always be loopholes to scam people of their hard-earned money.

In Ghana, there are at least three major telecommunications companies all having their own mobile money system. Ensuring to a degree that the system is not monopolized by one, but this leads to another inconvenience. In a region where there are agents of only one mobile money system say MTN, the users of other networks would not have access to their money. Furthermore, the transfers of cash between different networks, though not a herculean task for many, is far from seamless and incur extra charges. The human complexity of cryptocurrency apps has made cryptocurrency the playground of a select few. Even in far more developed countries the average person must be guided in crypto- trading because most applications have so many technicalities in their usage. With Ghana's high illiteracy rate (and even high financial illiteracy rate), we are not an exception (Mukhopadhyay, 2016). The Ghana cedis and mobile money systems are limited in the sense that neither one can ensure a secure and fast money transfer to anyone around the world at any time.

The use of cryptocurrency system provides protection against inflation caused by government's poor management of fiat currencies. A fast majority of the world are slowly embracing the system making it worth a market cap of trillions which is a testament to their faith in them. This peer-to-peer system cuts off the necessity for the bank and government's involvement. Most cryptocurrencies are mined using brute force algorithm so that the number of blocks mined per day remains approximately constant to control the rate of introduction of new currencies preventing any excess influx of the currencies that can lead to inflation. Moreover, cryptocurrencies are secured by cryptography, which makes it nearly

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impossible to counterfeit or double-spend. Every transaction must be verified by thousands of computers around the world. It gives the user pseudonymity which makes it more secure than the mobile money system. They are utilized for cross-border transactions to a limited extent. An excellent illustration of such decentralized transfers is flash loans in decentralized finance. These loans can be executed instantly and are used in trading because they are done without supporting collateral.

Cryptocurrency is the new wave that the world is riding on, an innovative technology which has the prospect to dethrone the current finance system and if care not taken Ghana will be left behind. This project was proposed to facilitate secure crypto transactions and trading. Trading involves the buying and selling activity between a buyer and a seller. The commodity that the two parties can exchange are such as fiat, stocks, bonds, or crypto currency. Crypto currency is a digital currency or digital asset that is decentralized and not regulated by any bank. The decentralization of cryptocurrencies is based on blockchain technology, which is a distributed ledger system where each node is linked together in a peer-to-peer (P2P) network. Each node in the network owns a similar copy of the ledger or transaction, which is verified and synchronized with the creation of a new block through a consensus protocol. The consensus protocol eliminates the need for a centralized or trustworthy entity, such as a bank or government agency (Uriawan, 2020). After reaching an all-time high of $3.3 trillion on December 29, 2021, the global crypto market capitalisation was $2.21 trillion (CoinMarketCap). The value of the cryptocurrency market has increased by a factor of six since November 2020, when it was only slightly more than $578 billion. In May 2021, the average daily trade volume reached a peak of $500 billion before levelling out at $120 billion (Statista). Due to its long history of increasing in value, investors continue to have faith in Bitcoin, the first decentralized digital currency underpinned by blockchain technology. With a market cap of nearly $1 trillion, Bitcoin holds a market dominance of 40% as of December 2021, followed by Ether, which benefits from a 20% dominance, and other altcoins (coins other than Bitcoin) such as Solana and XRP.

The number of blockchain wallet (instrument needed by crypto owners to store and manage their crypto) users went from 0 to 80 million in the past 10 years (Statista) This gives a clear snapshot of the increase in popularity of cryptocurrency as a form of payment (Puspitawati, 2021). The underpinning blockchain technology of cryptocurrencies inherently allows for fast, secure, and tamper-proof recording of transactions. Nonetheless, cryptocurrencies aren't immune to cybercrime, crypto-thefts, and frauds. In 2021, global crypto thefts accounted for a loss of $681 million. The weak link in this system is largely due to the exchange or trading platform, which mostly are built on a Web 2.0 architecture using centralized protocol. This architecture makes lots of exchange platforms still vulnerable by design to account for hacking and false transaction scams, quite like any other web application (Rahayu, 2022).

The purpose of this paper is to discuss the context of smart contracts and how they can be implemented to develop a safer and secure decentralized platform for

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trading and exchanging decentralized digital assets like cryptocurrencies to smoothly usher us into the age of cashless system and provide a more secured means of exchanging, accessing, and trading cryptocurrencies.

2. RELATED WORKS

This section gives a chronological and thorough condensation of cryptocurrencies from the time of its conception to the current trends and evolutionary milestones. Dating back to 1980s where the first attempts started, then to the first token currency of 90s and eventually the blockchain technology together with its derivatives.

One of the first attempts at cryptocurrencies occurred in the Netherlands in the late 1980s. A batch of developers sort to link money to smart cards designed to cater for night-time thefts on petrol stations. Vehicle drivers would use these cards as a means of transaction instead of cash, leaving no paper monies around for thieves.

Around that time, David Chaum, an American cryptographer experimented on another form of electronic cash. He imagined a token currency which could be sent among people privately and securely. He developed a formula he called the "blinding Formula" which would be used to encrypt information transferred between individuals.

The "blinded cash" as he would call it could be transferred among individuals who would be having a signature of authenticity. He went on to establish Digicash where he would put his idea into practice. Though his company went bankrupt, his concepts and formulas of encryption played key roles in the development of subsequent currencies.

Start-ups began making efforts to further the goals of Digicash in the 1990s. Companies like Paypal which is likely the company with the largest lasting impact on the financial world were created. Individuals could send and receive money over a web browser quickly and securely. It inspired other startups like e-gold which attempted to create a platform where precious metals like gold could be traded. E-gold gave individuals online credit in exchange for physical gold and other precious metals. It was shut down eventually due to scams and other issues (Digital curency, 2007).

In 1998, Wei Dai, a computer engineer and graduate of the University of Washington first revealed b-money. It was purposed to be a distributed electronic cash system which would be anonymous. Wei described b-money as "a scheme for a group of untraceable digital pseudonyms to pay each other with money and to enforce contracts amongst themselves without outside help". Although b-money was never officially launched, b-money endeavoured to render many of the services offered by cryptocurrencies today (Buntinx, 2016).

Around the same period, Nick Szabo created Bit Gold. Bit Gold came with a proof-of-work system that mirrors bitcoin mining process in certain ways. Proof-of-work is a consensus mechanism that is used to confirm and record cryptocurrency transactions.

It's a means of adding new blocks of transactions to a cryptocurrency blockchain. It involves generating hash

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codes that would have to match the target hash code for the block. Szabo's Bit Gold had its most revolutionary aspect to be its decentralized status. Thus, Bit Gold sort to avoid reliance on centralized and authorities. Ultimately, Bit Gold also proved unsuccessful as B-money but gave inspiration for future digital currencies.

As one of the most successful prebitcoin digital currencies, Hashcash was also developed I the mid-1990s. It was developed for purposes of minimizing email spam and preventing DDos attacks. Hashcash also used a proof-of-work algorithm which would aid the generation and distribution of new coins like modern cryptocurrencies. Just like previous developments, Hashcash also became less effective due to increased need for processing power though most of its elements were used in the development of bitcoin (Griffith, 2014).

A blockchain is naturally a network of connected computer systems that duplicates and distributes a digital ledger of transactions. A blockchain divides its data into temporally and cryptographically linked blocks. A blockchain is often a sort of database that only allows for reading and adding. The peer-to-peer network nature of blockchain is a result of its decentralized architecture. As a result, users (peers) communicate with one another directly without the aid of authorities or other trustworthy intermediaries. The blockchain technology was used to implement Bitcoin and other contemporary cryptos. Many blockchain applications have been developed over the years and have revolutionised the way people view digital currencies. Commonly cited applications include using digital assets on a blockchain to represent custom currencies and financial assets, the ownership of an underlying physical device, non-fungible assets such as domain names and more advanced applications such as decentralized exchange among others. Another important area of the blockchain technology is the use of smart contracts. These are systems which automatically move digital assets according to arbitrary pre-specified rules. For example, one might have a treasury contract of the form "A can withdraw up to X currency units per day, B can withdraw up to Y per day, A and B together can withdraw anything, and A can shut off B's ability to withdraw".

When Satoshi first established Bitcoin in January 2009, he was simultaneously coining two radical and untested concepts (Nakamoto, 2008). The first is the bitcoin, a decentralized online currency which is peer-to-peer and maintains a value without any backing, intrinsic value, or central issuer. So far, bitcoin as a currency has taken up majority of the public attention, in terms of both the political aspects of a currency without a central bank and its extreme uncertain volatility in price.

However, there is also a different, equally important, aspect of Satoshi's grand experiment. Thus, the concept of a proof of work-based blockchain that allows for public consent on the issue of transactions. Bitcoin can be described as a first-to-f system. Thus, if an individual has 60 BTC, and simultaneously sends the same 60 BTC to entity A and to entity B, only the transaction that gets validated first will be processed. Many cryptocurrencies of modern days then started emerging using the concept of bitcoin. In a paper by Lee and Cho (2018), Exeum was introduced, a decentralized

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architecture that issued pegged token backed by world assets, including fiat currencies. Pegged tokens are over-collateralized by the virtual assets exchanged in the decentralized virtual asset trading provided by the structure, effectively remoulding the price stability dilemma into maintaining the disparity between the virtual asset exchange and real-world exchanges.

The system implemented several mechanisms to motivate market makers and preserve the peg – a rebate for maker orders, the swap rate adjusted based on the demand of the asset in the exchange, and loose protection of the peg by the Market Maker DApp and the initial reserve. The Exeum project to democratize market making activity by enroling arbitrage miners, using the market making software provided by Exeum (Lee & Cho, 2018).

In a 2018 paper, Chi Ho Lam disclosed a system to support a P2P cross chain crypto asset exchange based on signature scheme to facilitate a P2P cross-chain crypto asset exchange. The system provides a universal secure and direct way for traders to exchange crypto assets across different chains without hassle.

The benefit of this mechanism was that it applied to the signature level instead of the protocol level (Lam, 2019). A study in 2019 by Stanislaw Dro˙zd˙z, and his colleagues from Complex Systems Theory Department, Institute of Nuclear Physics, Polish Academy of Sciences, provided unwavering support for the hypothesis of the gradual development of a novel and partially independent market, synonymous to the worldwide foreign exchange (Forex) market, wherein cryptocurrencies are traded in a free-standing manner.

In more practical terms, this meant that not only the Bitcoin but even the whole emerging crypto market may, eventually, offer 'a hedge or safe haven' for currencies, gold, and commodities. In a 2020 paper Mohd Faizal Yusof and his colleagues aimed to clarify how to implement a cryptocurrencies payment platform which comprised of a web component to allow end-users to declare cryptocurrencies owned by them, a mobile component to support end-users who prefer mobile phones and a backend system to manage the collection of zakat in cryptocurrencies and integration with the entire system (Yusof, 2021).

Stefan Ciberaj and Martin Toma´sek in their 'crypto trading platform's article included a prototype implementation of a proof-of-concept architecture for a bitcoin trading platform. An Android client with a focus on user experience (UX) and an application programming interface (API) the client utilizes that is also directly accessible to users make up the offered interfaces. The server leverages cloud computing design patterns and is made up of microservices. It has a trio-tier architecture with a focus on scalability (Fang, 2022).

Another 2021 study by method and system for crypto-asset transfers were introduced by Berengoltz and his associates. The method includes sharding a wallet private key so that each shard is given to a different secure module, generating signatures by each secure module based on a respective shard of the sharded wallet private key and obtained trading platform credentials, and verifying the crypto-asset transaction

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when a threshold of the generated signatures is found to match (Brenglotz, 2021).

An issue with a sharding-based strategy is the security worry that develops when a shard is hacked, leading to shard takeovers where one shard attacks another and information is lost (Frankenfield, 2021; Presthus, 2017; Binns, 2022).

3. METHOD

3.1. System Architecture

The system architecture is as depicted in Fig. 1. A user accesses or enters the URL of the decentralized trading platform (e.g., slimetrader.com) which displays the User Interface (UI). The static files for the UI are retrieved via IPFS (a decentralized off-chain storage solution). When the user initiates a transaction, forms are provided for the details of the transaction to be entered.

Transaction Details are commodity / cryptocurrency to transfer, recipient address and amount. On clicking submit, the transaction is encrypted or signed with the user's private key by Meta Mask (All write actions must be signed, otherwise the transaction will be rejected by the nodes on the blockchain).

Providers like Meta Mask offer nodes that allows the user / frontend to connect and interact with the blockchain.

The smart contract consists of the business logic that automatically processes the transaction details in the Ethereum virtual machine and checks if sender balance is enough for the transaction or debit the sender's account or verify the recipient's wallet address or credit the recipient's address with the debited amount.

The nodes verify the transaction via a consensus protocol, once approved the transaction is then hashed as a block onto the blockchain (as a result no 3rd party or central authority is required to provide trust). This data stored in the blockchain is queried and sent to the frontend to be displayed.

3.2. System Block Diagram

The cryptocurrency platform, in this case represented with a block diagram, as illustrated in Fig. 2 contains mainly four (4) blocks namely the User Block, Frontend Block, Provider Block and Ethereum Blockchain Block.

The procedures for transaction are as explained in subsection titled "System Architecture".

3.3. System Workflow

The system workflow is as shown in Fig. 3. User loads application in an internet browser and logs in / signs up using a Meta Mask wallet account. If a user does not have a Meta Mask account, direct the user to the Meta Mask page to acquire one.

On logging in, the dashboard is loaded to show transactions and your account holdings. If the user wants to make a transaction, the user clicks on the send button and a form is displayed and the user can fill in details of the transaction which includes the name of receiver and amount to be transferred.

After which, the user clicks on the submit/make transfer button to initiate the transaction.

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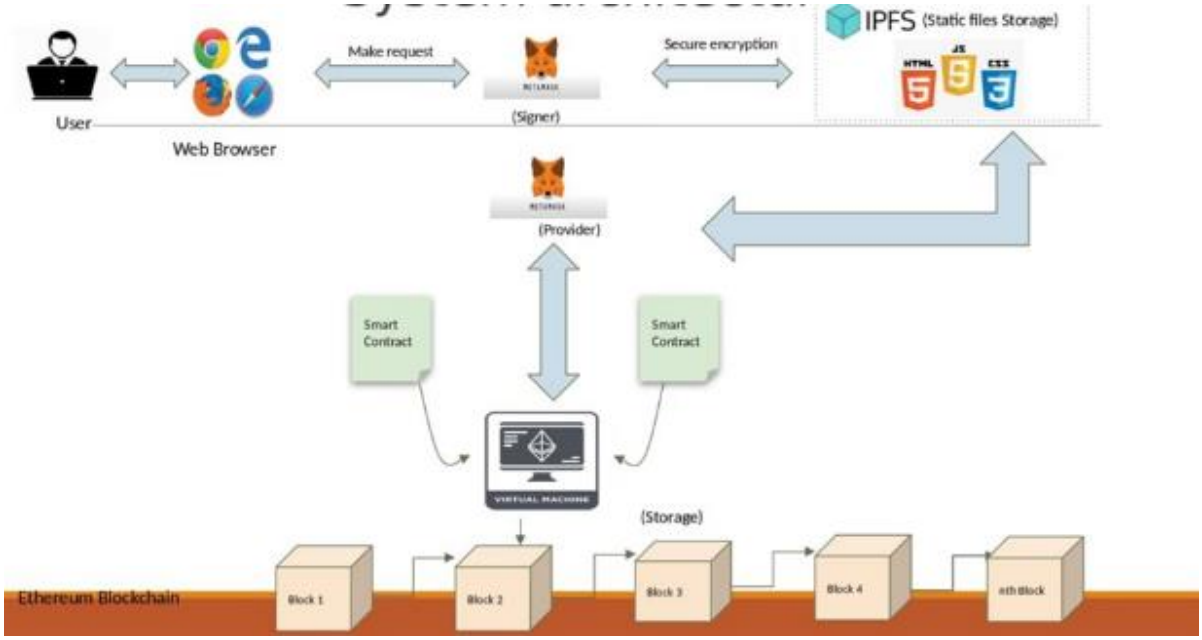

Fig. 1. System Architecture

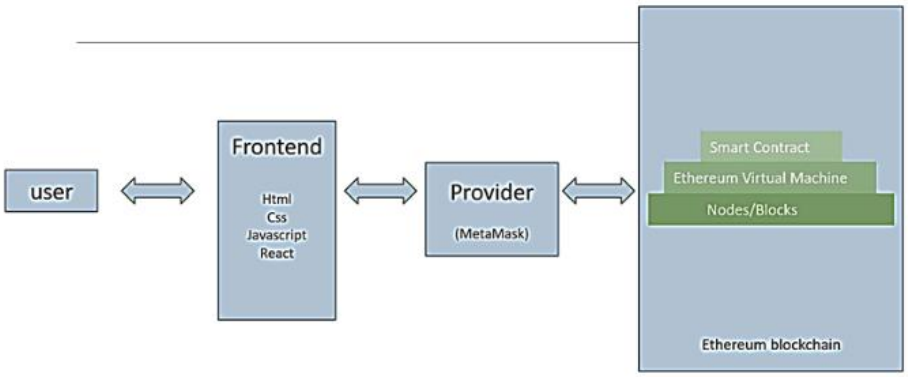

Fig. 2. System Block Diagram

A confirmation popup message is displayed for the user to verify the transaction and if the user confirms, the transaction is made, and the user is redirected to the dashboard.

Current holdings are displayed on the dashboard. But if the user's wallet is credited, a notification appears as a popup. The user clicking on the notification will be directed to the dashboard to view the update.

3.4. System Software Design

The system software was designed using modular method. The modules or software components are Frontend, Login, Transitions and Backend and this is illustrated graphically in Fig. 4 and detailed descriptions are given in Table 1.

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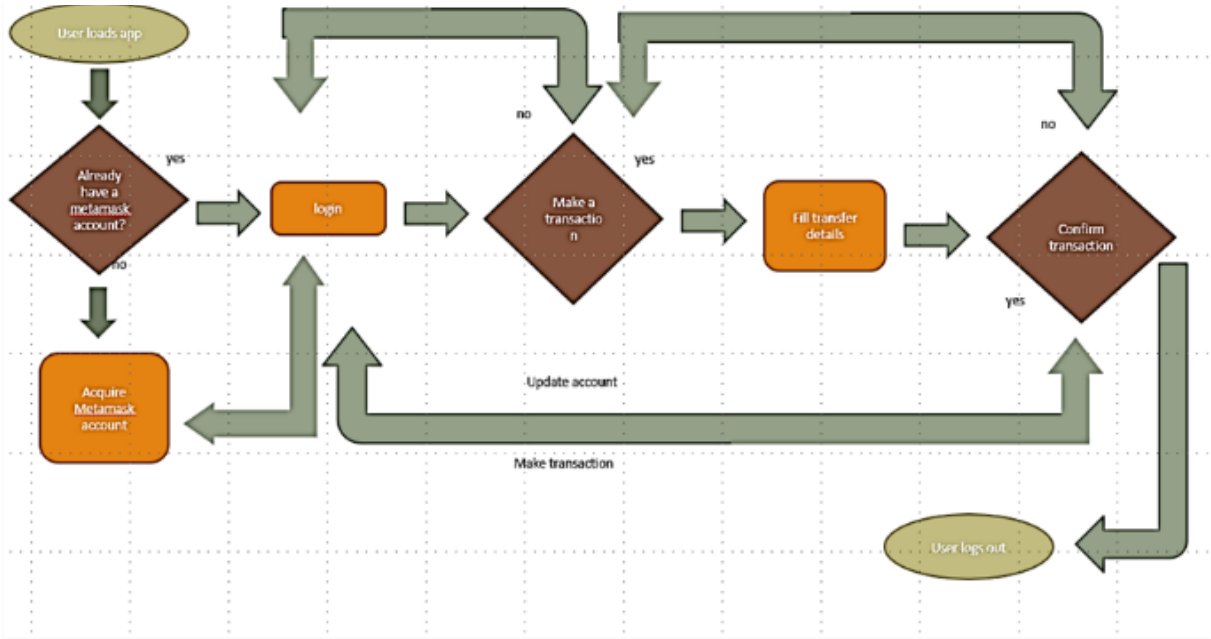

Fig. 3. System Workflow

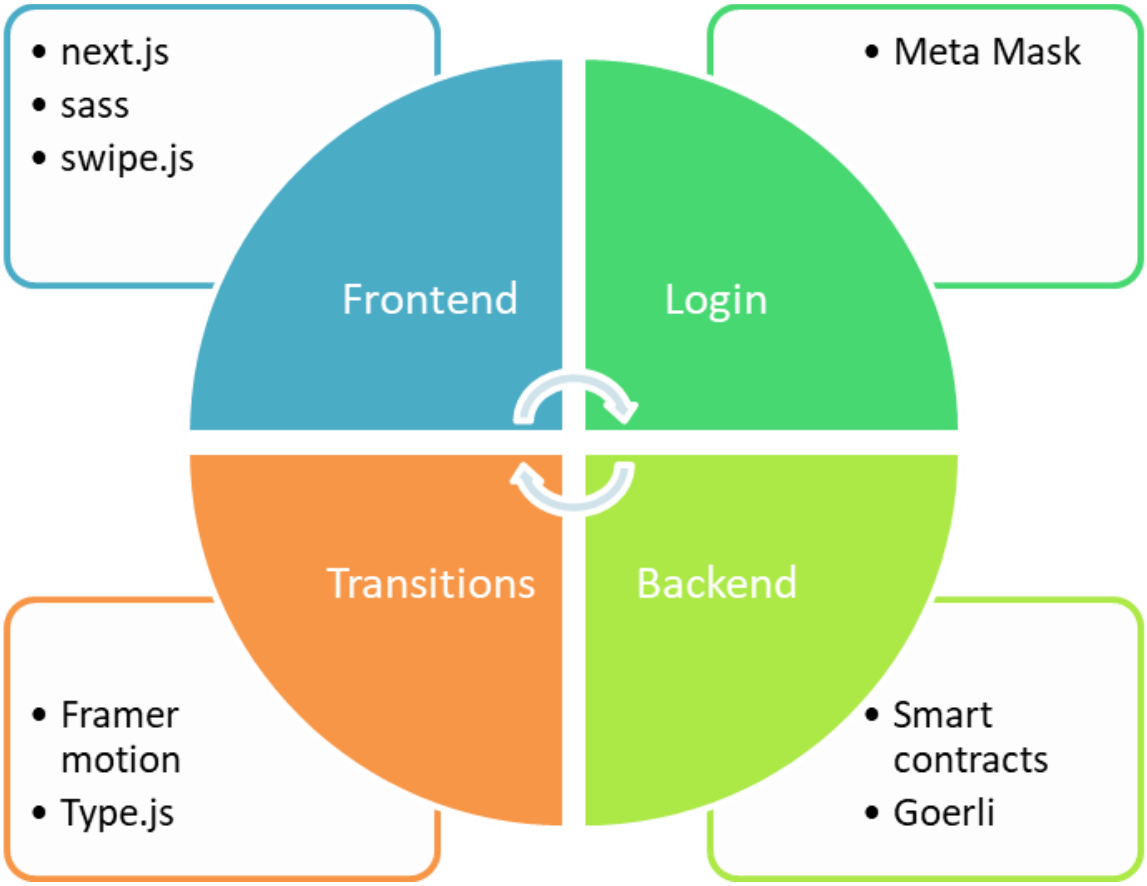

Fig. 4. System Software Design Diagram

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Table 1. Software Design Components and Description

Frontend Development	
Next.js	Next js is a framework built on React js which is a JavaScript framework designed to be declarative, component-based, and portable. React makes it easier to create interactive user interfaces. React efficiently updates and renders just the right components when data changes after designing simple views for each state in an application. Since the logic of a component is written in JavaScript instead of templates, you can easily pass data through your app and keep state out of the DOM.
Sass	Sass is the most mature, stable, and powerful professional CSS extension language in the world. Sass boasts of more features and capabilities than any CSS extension language out there and that is why we opted for it in our project.
Swipe.js	Swiper is a modern mobile touch slider with hardware accelerated transitions and amazing native behaviour. It is purposed to be used in building mobile websites, mobile web apps, and mobile native or hybrid applications. Swiper, along with other great components, is a part of Framework7, a fully featured framework for building iOS & Android app. This helps to comply with a multi-platform compatibility like Digi Crypto. Swiper comes with a very resourceful API. It allows for the creation custom paginations, navigation buttons, parallax effects and other vast options.
Log In	
Meta Mask	To help secure and useable Ethereum-based websites, Meta Mask was developed. It specifically takes care of account administration and establishing a user's connection to the blockchain. Users who already have the Meta Mask extension installed can easily log in on the landing page by clicking a button. The user is routed to the official Meta Mask extension download page to install Meta Mask if it is not already installed. At window. Ethereum, Meta Mask accesses a worldwide API into websites that its users browse. Websites can access users' Ethereum accounts with this API, read data from the associated blockchains, and recommend that users sign messages and transactions. The provider object's presence suggests an Ethereum user.
Transitions	
Framer motion	An interactive design tool for websites and prototyping is called Framer. Building complete marketing sites, landing pages, online campaigns, and much more are its strong points. It covers each step of the design process, from interactive prototypes to graphic mock-ups, but its key advantage is publishing right from the canvas. Because you can ship your design right away and all app transitions use it, Framer is the quickest tool for building sites.
Type.js	Type of JavaScript programming language tool
Coin Ranking	API to integrate cryptocurrency prices into your app or website. Gain access to high-quality data about all coins, like price history, circulating supplies, exchanges, trading pairs, and much more. The account page is customized to fetch current data about the user's wallet coins or assets specifically (See Fig. 5)
Backend Development	Smart contracts, Goerli

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Figure 5 is shows the Display of Coin Ranking Api. To initiate testing, recharts were built on top of SVG elements with a lightweight dependency on D3 submodules. A chart was customized by tweaking component properties and passing in custom components, quickly building the chart with decoupled, reusable React components. Fig. 6 depicts the system dashboard with charts and recharts.

Form functionality and validation were facilitated using the Formik package which takes care of the repetitive functions—keeping track of values/errors/visited fields, orchestrating validation, and handling submissio

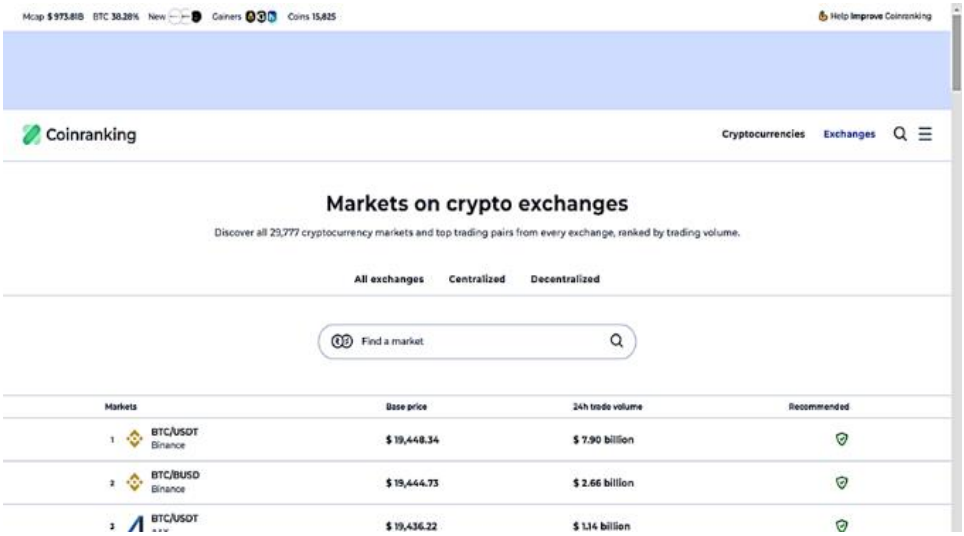

Fig. 5. Display of Coin Ranking API site

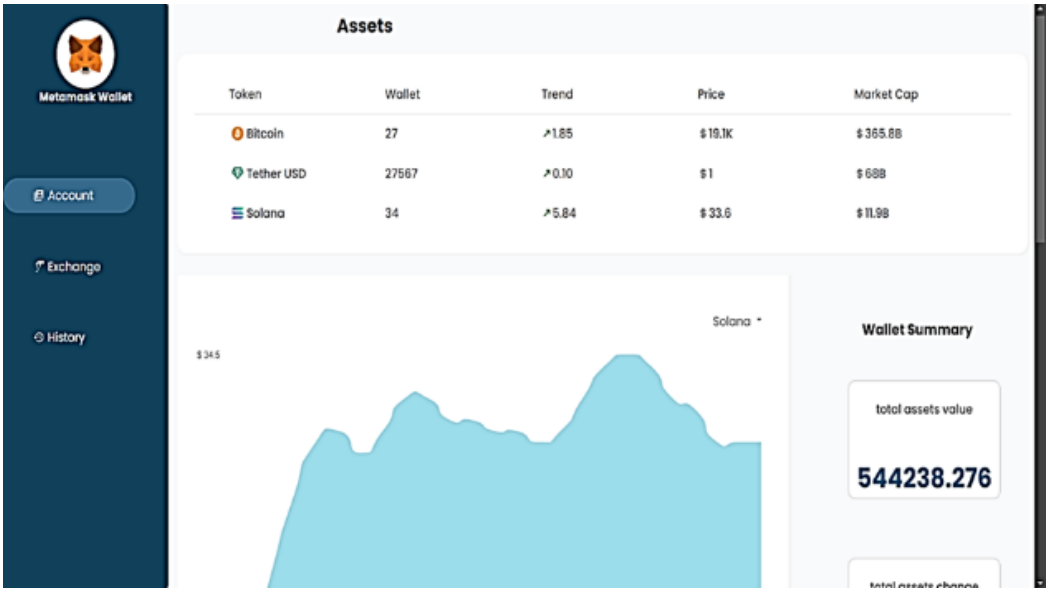

Fig. 6. Dashboard Display

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By staying within the core React framework and away from magic, Formik makes debugging, testing, and reasoning about forms intuitive.

The system software application was deployed to the IPFS using Fleek. Fleek is a deployment platform employed in this system.

Fleek allows for continuous deployment in that, when any change is made and pushed to GitHub, the change would automatically be seen on the deployed site. The Fleek interface is as displayed in Fig. 7.

Smart contracts were written using solidity to define the logic for performing transactions and storing the data on the blockchain. Contract Application Binary Interface (ABI) were developed from the smart contracts. This encodes the interface of the smart contract for the UI. That is, it tells the contract-abstraction library, for example ethers, what functions to provide.

Finally, a Goerli wallet address was created and a Goerli faucet was used to deposit virtual ether into the created wallet. Goerli is a test net for deploying application into a sandbox, a test environment, for the development face of a project. Alchemy was used to deploy the smart contract to the Goerli test net.

A network to deploy the contract to (either the Ethereum main net or a test net) and wallet address to use was defined in the hardhat config file. The hardhat config file is a file that allows definition of conditions for deploying our smart contracts.

Lastly, a context processor was defined in the frontend to provide the contract ABI and to define other functions for manipulating the wallet. Also, the processor monitors wallet related events, performed by user in the frontend.

4. RESULTS AND DISCUSSION

Various tests were run to see if all functionalities were working as expected. That is, to be able to send and receive tokens on our decentralised application. The so called `goerli' network was used as basis for intensive tests.

This goerli network test was done before doing real testing on an Ethereum network, since the deployment process is irreversible. The procedure for this testing is as described in the following. The Goerli Test Net provided two users signed unto the platform via Meta Mask with virtual Ethereum tokens through its goerli faucets.

Two users, User A and User B signed into the application via Meta Mask. With the virtual Ethereum tokens provided by the goerli faucets, user A sent some tokens to user B's account.

This transaction was made possible to the Meta Mask wallet. The wallet address of user B was provided for user A. This address was used by user A in the locating user B's account to the send the virtual Ethereum tokens.

The tokens were successfully received by user indicating a successful transaction. Testing results were as expected, i.e., the system was able to successfully send and receive tokens seamlessly.

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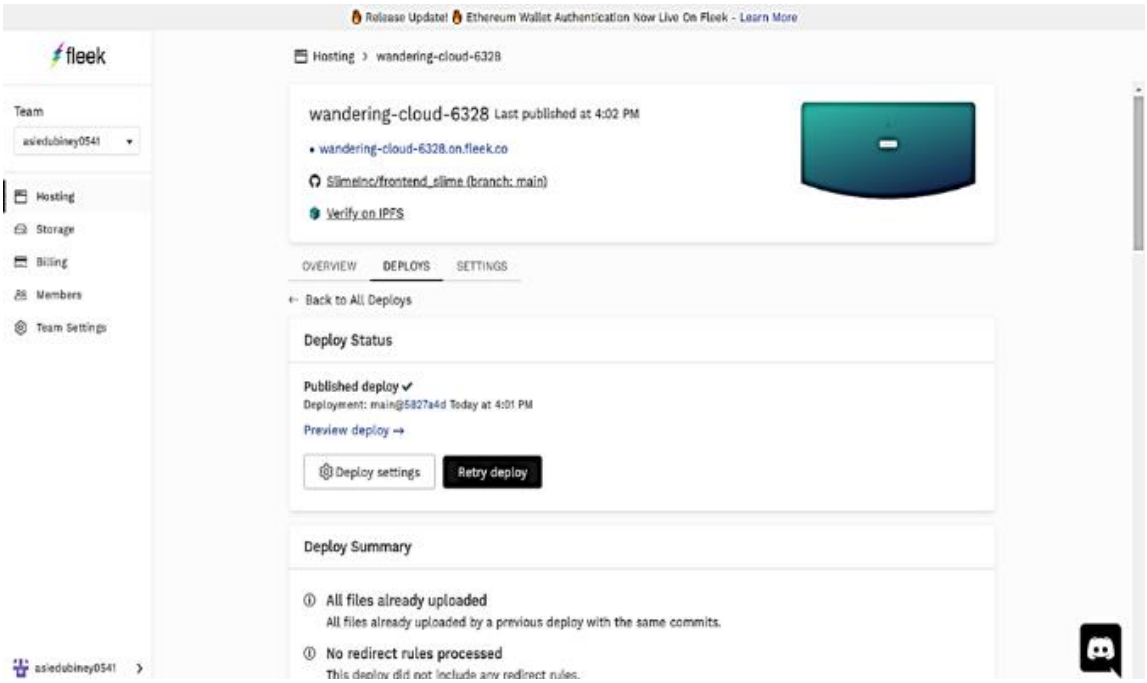

Fig. 7. Display of Fleek Interface

5. CONCLUSION

This paper has established the problems associated with centralised finance applications and successfully demonstrated the process of sending tokens from one Ethereum based wallet to any other Ethereum based wallet using Meta mask.

The project's aim to develop a completely decentralised platform was achieved since the use of Meta mask wouldn't require any central body to make transactions and other functions.

It was demonstrated that the frontend of the application could also be hosted on a decentralised platform and would allow for the exchange of tokens between wallets that are outside the Ethereum network using bridging software.

It would enable the direct deposit of fiat currencies as well and would integrate a platform to allow users to trade Ethereum based tokens.

REFERENCES

Berengoltz, P., Ofrat, I., & Shaulov, M. (2021). *U.S. Patent Application No. 17/172,794*.

Binns, D. (2022). No Free Tickets: Blockchain and the Film Industry. *M/C Journal*, *25*(2).

Buntinx, J. P. (2016). Top 4 Cryptocurrency Projects Created Before Bitcoin.

Digital Currency Business E-Gold Indicted for Money Laundering and Illegal Money Transmitting: https://www.justice.gov/archive/opa/pr/2007/April/07_crm_301.html

DOI: https://doi.org/10.34010/injiiscom.v3i1.8359
p-ISSN 2810-0670 e-ISSN 2775-5584

Fang, F., Ventre, C., Basios, M., Kanthan, L., Martinez-Rego, D., Wu, F., & Li, L. (2022). Cryptocurrency trading: a comprehensive survey. *Financial Innovation*, *8*(1), 1-59.

Frankenfield, J. (2021). Bitcoin. *Investopedia, Feb*, *18*.

Griffith, K. (2014). A quick history of cryptocurrencies BBTC-Before Bitcoin. *Bitcoin Magazine*, *16*.

Lam, C. H. (2019). *U.S. Patent Application No. 16/429,075*.

Lee, J., & Cho, M. (2018). Exeum: A Decentralized Financial Platform for Price-Stable Cryptocurrencies. *arXiv preprint arXiv:1808.03482*.

Mukhopadhyay, U., Skjellum, A., Hambolu, O., Oakley, J., Yu, L., & Brooks, R. (2016, December). A brief survey of cryptocurrency systems. In *2016 14th annual conference on privacy, security and trust (PST)* (pp. 745-752). IEEE.

Nakamoto, S., & Bitcoin, A. (2008). A peer-to-peer electronic cash system. *Bitcoin.–URL: https://bitcoin. org/bitcoin. pdf*, *4*, 2.

Presthus, W., & O'Malley, N. O. (2017). Motivations and barriers for end-user adoption of bitcoin as digital currency. Procedia Computer Science, 121, 89-97.

Puspitawati, L., & Ahmad, A. (2021). Information System for Forex Investment and Their Effects on Investment Growth in Foreign Currencies. *International Journal of Research and Applied Technology (INJURATECH)*, *1*(1), 127-133.

Rahayu, S. (2022). Implementation of Blockchain in Minimizing Tax Avoidance of Cryptocurrency Transaction in Indonesia. *International Journal of Research and Applied Technology (INJURATECH)*, *2*(1), 30-43.

Toby Shapshak: Mobile Money In Africa Reaches Nearly $500bn During Pandemic: https://www.forbes.com/sites/tobyshapshak/2021/05/19/mobile-Money-in-africa-reaches-nearly-500bn-during-andemic/?sh=1175069b3493

Uriawan, W. (2020). SWOT Analysis of Lending Platform from Blockchain Technology Perspectives. *International Journal of Informatics, Information System and Computer Engineering (INJIISCOM)*, *1*(1), 103-116.

Yusof, M. F., Rasid, L. A., & Masri, R. (2021). Implementation Of Zakat Payment Platform For Cryptocurrencies. *AZKA International Journal of Zakat & Social Finance*, 17-31.

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