



BloX - Blockchain Based Cryptocurrency Wallet for Web 3.0

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ABSTRACT

Web3 (also known as Web 3.0) is an idea for a new iteration of the World Wide Web which incorporates concepts such as decentralization, blockchain technologies, and token-based economics. Web3 enables tokenized economic interactions without intermediaries which means transactions in Web3 that are between two or more parties, does not require a middleman which improves privacy, autonomy and control of data. Cryptocurrencies are a form of token-based economics and is a huge part of web3, thus users need a place to store their cryptocurrencies. Addressing these concerns, this project aims to develop a Web 3.0 ready website where users can send and receive cryptocurrency called BloX. Analysis on respondents shows which factors are important to the usability of a wallet which were then implemented in the prototype system. The system went through a series of testing and passed the user acceptance test from 5 users which confirmed that all of the objectives of the research have been fulfilled.

Keywords:

Web 3.0; decentralization; blockchain technologies; token-based economics; intermediaries; Cryptocurrencies; BloX

1. Introduction

The internet is one of the most revolutionary inventions of modern times, allowing anyone to access a plethora of information from anywhere in the world. It all started from Web 1.0, the first stage of the internet that roughly lasted from 1991 to 2004. The future of internet or Web3 is an emerging technology that is based on the idea of a decentralized world wide web which incorporates new technologies such as blockchain and token-based authentication with the intended goal of creating a new internet where the users have power instead of being monopolized by large companies [1-3]. A key concept that would be a part of Web3 is the concept of cryptography or specifically cryptocurrency. Cryptocurrency is a digital or virtual currency that was made to be a medium of exchange through a computer network without any involvement from centralized bodies such as government to issue it or banks to manage accounts and verify transactions. One of the most

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popular ways to store cryptocurrency is by storing them in a crypto wallet. A crypto wallet is a device that stores the public or private keys for cryptocurrency in the blockchain. Technically, a crypto wallet.

This paper aims to develop a web3 ready website where users can send and receive cryptocurrency while also analysing Malaysian's perception towards cryptocurrency and web3 technologies. We will discuss the analysis, design, implementation and evaluation of the system. The paper will be structured as follows. Section 1 is to elaborate on the problem statement, the research objectives, and the report structure. Section 2 studies similar systems that have been developed in the past and ends with a comparison on each system. Section 3 explains the research methodology of the project, which consists of the chosen software development life cycle and the method used for requirements gathering. Finally, Section 4 shows the result of data gathering and the design of the system.

2. Systematic Review

Systematic review is a type of information gathering method that selects and identifies studies methodically to meet the requirements of a research. A systematic review usually aims to answer a main research question [1-4]. A systematic review usually adheres to a defined protocol in which the criteria of research is defined clearly before the review is conducted. It is a comprehensive search conducted over multiple databases and grey literature that can be replicated and reproduced by other researchers. Furthermore, in order to answer a specifically defined question, systematic review involves planning a well thought out search strategy beforehand to focus more on the research criteria. The keywords used, search strategies such as which database were chosen, and the inclusion/exclusion criteria needs to be included and justified in the review as well [3-6]. The first step in systematic review is to define the problem of the research and how to solve it. In other words, a primary research question must be formulated first which allows the formulation of the questions and methods of the review before retrieving the literature as this helps to minimize bias. The primary research question must not be too narrow or too broad as it can be difficult to reach a conclusion in both cases where a narrow research question could have too few studies done on it whilst a broad one could lead to an unsatisfying conclusion [2,4,6,7]. The goal of this research was to provide an overview of the usage and awareness of cryptocurrency in the Malaysian population.

After the primary question has been formulated the research protocol is developed. Research protocol is when the methods for literature searching, screening, data extraction and analysis is contained in a written document to minimize bias before starting the literature search. For example, what are the inclusion and exclusion criteria before a study is picked to be included in the systematic review. The search protocol that was used in searching for all the relevant scientific papers was to ensure that the terms used in the search string were chosen after pilot searches after a few possible keywords were tested [2,5,6]. After the pilot search, it was decided to include crypto or cryptocurrency wallet as the search string although other relevant keywords such as "blockchain" and "Bitcoin" could also be used. However, the problem with searching with "blockchain" and "Bitcoin" was that a lot of the research papers were related to the technological inner workings of blockchain and economic aspects of cryptocurrencies rather than the adoption of cryptocurrency. Since the main focus of this systematic review was regarding the usage of cryptocurrency, it was decided that the term bitcoin and blockchain were to be dropped in the search string. After the research protocol was determined and tested, the next step was choosing the scientific databases for the searches. To ensure the information gathered was trusted, the research concentrated on high quality papers that was published in conferences, books and journals that was related to the research

topic. Three scientific databases were used for paper retrieval which were IEEE Xplore, Springer Link and ScienceDirect.

Not all papers in the searches were related to the primary research question and they needed to be assessed for their actual relevance. After determining the research protocol, the next stage was to screen for papers. An article had to include the term “cryptocurrency wallet” or “cryptocurrency” which was typically emphasised in the title of the study. The screening process that was used in the review was based on Dybå and Dingsøyr [6-8]. He proposed that at the first screening phase, the papers were screened based on their titles and excluded studies that were not relevant to the research topic. For example, even after using the research protocol, some of the returned results were not related to the adoption of cryptocurrency wallet such as the different use of cryptocurrency wallets in other fields, thus these papers were excluded as it was clearly out of scope. However, in some cases it was quite hard to determine if the study was relevant to the primary research question just based on the title alone thus in the second phase of screening the abstracts of each selected study was studied to determine the relevancy. Furthermore, an inclusion and exclusion criteria were added to screen each paper. Any study with the following criteria were excluded: (i) articles that needs money to have full access to, (ii) articles that are not written in English, (iii) articles that discuss about the usage of cryptocurrency wallet in other fields such as education, (iv) any articles that do not include a reference list and (v) duplicate articles.

More and more investors around the globe have recently dipped their toes into the cryptocurrency industry which causes the market for cryptocurrencies to be rapidly expanding. The cryptocurrency wallet, which serves as a platform for receiving, sending, and trading cryptocurrency is getting a lot of traction lately. Over the years, statistics reveal a huge increase in the number of bitcoin wallet accounts [7-10]. A report made by the Organisation for Economic Co-operation and Development in 2019 states that out of 1000 respondents in Malaysia, 23% of them currently holds some form of cryptocurrency [8]. A report made by The Malaysian Reserve says that Malaysian investors have an increase in cryptocurrency activities in the Digital Asset Exchanges spaces. More and more Malaysians are currently taking part in the global phenomenon of diversifying their assets into digital currencies. This was indicated when Luno, Malaysia’s most popular cryptocurrency wallet which boasts 4 million users shows a 50% uptick in active users recorded. The data collected also shows the total volume on the exchange grew by 33% [8-10].

As recession and inflation worries increase day by day, it seems that investors are trying to hedge against it by investing in cryptocurrencies. Besides that, Omar and Rana from Universiti Kuala Lumpur Business School that studied the perception of cryptocurrency among the Generation Z in Malaysia concluded that Generation Z have a high intention of adopting cryptocurrency. This is due to them having a lot of experience with technology at a young age which makes them more receptive to integrate new technologies in their lives whereas its harder to market cryptocurrency to older generation who are reported to be less educated in terms of using new technology [10-13]. In a study which aims to investigate the social factors that influence the awareness of cryptocurrencies among young working adults in Malaysia found out there are three important factors. Those factors are there must be a positive relationship between social acceptance, trust and confidence with cryptocurrencies among young adults in Malaysia. In the study shows that if the level of trust in government monetary systems is low, the higher the awareness for cryptocurrency is. Additionally, in terms of social acceptance, previous studies suggest that not only family and professional social levels, but also political social acceptance plays an important role in influencing awareness of cryptocurrencies. In conclusion, the perception and awareness of cryptocurrency is medium in Malaysia especially among the younger generations, however more strides need to be made to include the adoption of cryptocurrency among older generation as well [7-11].

2.1 Review of Similar and Existing System

In this section, we compare various existing system that is a cryptocurrency wallet. The first one is Coinbase. Coinbase is an American based cryptocurrency exchange platform that went public on the Nasdaq via a direct listing [12-14]. Coinbase user interface is very beginner friendly which helps lower the barrier of entry to cryptocurrency trading. However, a drawback of Coinbase is that it uses Amazon Web Services which means all the user data is centralized in one platform. If amazon experiences failure, the whole website could shut down.

Cash App is a peer-to-peer money transfer system developed by Block, Inc in October 15, 2013 and is only available in the US and UK [13-15]. Cash App only allows bitcoin transaction and has not expanded to support another cryptocurrency. Based on the research done, Cash App is very mobile app centric and is not that suitable to use for desktop users. Furthermore, the app also does not have a cryptocurrency price tracker for other coins aside from Bitcoin.

Bisq is not considered as a company, instead it is a downloadable cross-platform software that serves as a bitcoin exchange network that is decentralized. Bisq works by forming a peer-to-peer network by working with other networks to integrate its trading protocol which enables users to facilitate any cryptocurrency exchange with each other without the need of a third-party exchange service. A drawback of Bisq is that it can only trade bitcoin, and currently there is no price tracker for other cryptocurrencies[12-15].

Binance is cryptocurrency exchange founded in China in 2017 by Changpeng Zhao with an emphasis in altcoin trading. Currently, Binance is the largest cryptocurrency exchange in the world when it comes to sheer trading volume. Binance,, although a very comprehensive cryptocurrency exchange platform with different user functionalities shares the same drawbacks with coinbase. The network is centralized to one database and if the the database fails so does the platform, this is also known as single point of failure [14-17].

Tel Aviv-based eToro was launched in 2007 by co-founders Ronen Assia, David Ring, and Yoni Assia. Assia is still leading the company as CEO today. Originally operating under the name RetailFX as a forex online broker, the company later changed its name to eToro and started offering commodities, indices, and stocks. In 2018, eToroX was launched which was the company's answer to all the hype regarding cryptocurrency. It was their own version of a cryptocurrency wallet [16-18].

3. Research Methodology

The research will be using quantitative analysis in the form of survey, specifically an online questionnaire since it has a low return rate and individual are more willing to respond to it as their identity remains anonymous. The types of questions that will be presented in the questionnaire are as follows Likert scale questions and single answer questions. A single answer question is a survey question that employs the radio button format of the circular button that represents the choices in the list to allow respondents to select only one answer from a list of options. On the other hand, Likert scale questions are surveys that are used to measure the thoughts and feelings of respondents and consist of a variety of alternatives ranging from strongly disagree to strongly agree. The questionnaire will be using the 5-point Likert scale which is a type of psychometric response scale to help responders specify their level of agreement to a statement in five points: (i) Strongly disagree; (ii) Disagree; (iii) Neither agree nor disagree; (iv) Agree; (v) Strongly agree. Respondents' opinions or attitudes concerning the topics under discussion were measured using a Likert scale, the survey will be using Google Forms as it is the most popular survey tool available to make respondents more willing to answer the survey. The questionnaire aims to collect at least 70 responses [18,19].

2.1 System Development Methodology

The SDLC (software development life cycle) is a framework that defines the tasks that must be completed at each stage of the software development process. The life cycle is a methodology for enhancing software quality and the development process as a whole. The software development life cycle (SDLC) is the process that a development team follows within a software company in order to provide high-quality software that matches or surpasses client requirements, as well as deadlines and budgets. SDLC simply specifies each action required to build a software program, which helps to decrease waste and improve the development process' efficiency. Planning, requirements, design, build, test, deploy, and maintenance are the six phases that are commonly followed. This concept applies to both configurations of hardware and software or even both [18-22]. In order for a smooth development of the project selecting the correct methodology is important. There are many methodologies out there such as Waterfall, Iteration, Rapid Application Development (RAD) and Spiral mode. After comparing each of them, the best system the chosen system development methodology model for this project is the modified waterfall technique. There are several stages for this methodology which are analysis, design, coding, testing, deployment and maintenance. The waterfall model is also referred to as a linear-sequential life cycle model because it illustrates the software development process in a linear sequential flow in the sense that any phase in the development process begins only if the previous phase is complete. However, one of the weaknesses of this methodology is that as soon as a stage of the development is completed, the development for the next stage is immediately started and going back to the previous phase is impossible. Thus, instead of using the standard methodology, the modified waterfall method was chosen because it is easier to change requirements during project development this is because unlike standard methods it can be reversed, and modifications can be made where needed by returning to previous phases [23-26].

4. Results and Analysis

4.1 Survey

The process of requirements gathering is done through a questionnaire. The questionnaire is distributed through UCSI Course Networking and reddit.com to 73 respondents. Questions that are asked include the respondent's opinions on the factors that affect the usability of cryptocurrency wallet and their willingness to adopt web3 technologies. The questionnaire was divided into four sections. The first section was regarding the demographic of the respondents. The data showed that the largest demographic group that participated in the survey was males between the ages 22-24 that was still finishing their tertiary education. The data also shows that 65.8% of the respondents have experience in using cryptocurrency wallet and holds Bitcoin in their mobile crypto wallets. The second section was to find out the respondent's perception towards their assets and decentralized apps. Based on the analysis done, most agreed that they felt more secure storing their assets in a centralized financial system as opposed to a decentralized one. However, 49.3% out of the 73 respondents strongly agreed that they are willing to try decentralized applications in the future.

The third section was to find out the factors that influence the usage of cryptocurrency wallets. To summarize all the data findings, most respondents agree that a cryptocurrency wallet needs to have a transaction history, a portfolio balance feature, an aesthetically pleasing user interface and finally must also be connected to a platform that allows users to buy and sell crypto. The final section was regarding the respondents web3 knowledge. A huge amount of the respondents or 60.3% of them strongly disagreed that they had a very extensive knowledge on web3 technologies.

Furthermore, more than half or 62% of them were reluctant to stop using centralized platforms such as Facebook or Google to be a first adopter of web3 technologies. However, surprisingly a majority of the respondents were willing to convert their fiat money to cryptocurrency to use web3 decentralized payment systems.

4. The BloX System

In the Unified Modeling Language (UML), a use case diagram can be used to summarise the details of the system and how end users (actors) interact with the system. In the case of BloX as shown in Fig. 1 there are five main actors that interacts with the system which are the end users, Moralis, MetaMask, Rinkeby Testnet Network and CryptoCompare API. The use cases are Log In, Check Transaction, Check Balance, Transfer Cryptocurrency, View Live Prices and Sign Out.

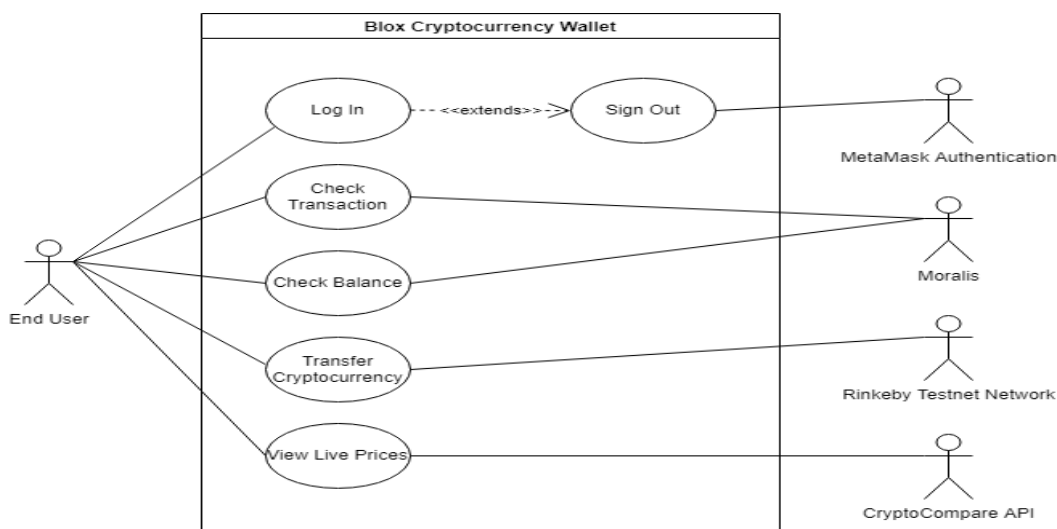


Fig. 1. BloX Use Case Diagram

An activity diagram is a flowchart that illustrates the movement of information from one action to the next. The control flow of one action to another is depicted where the flow can be sequential, branching, or running at the same time. As shown in Figure 2, the system will display the login screen with a login button. After the user clicks the login button, a Metamask authentication will pop up asking the users to validate and sign in through their wallet. After the authentication is successful, the user will be brought to the website's homepage.

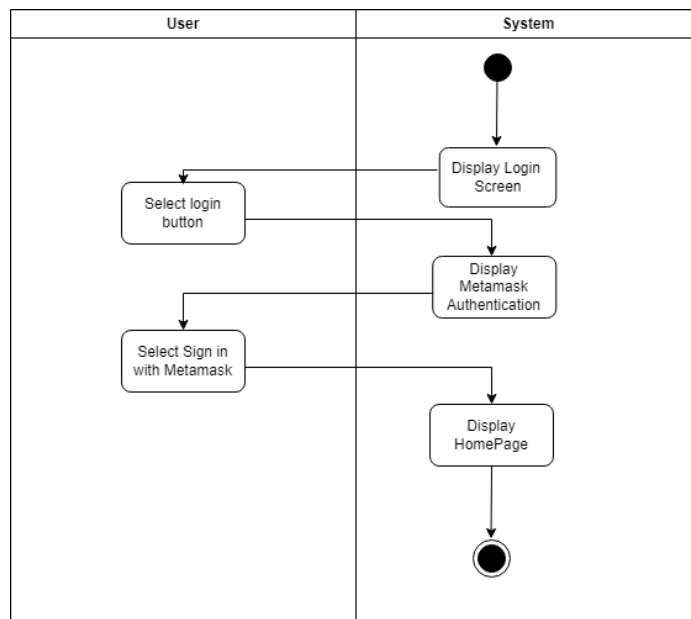


Fig. 2. Login Activity Diagram

For this project, the chosen database is Moralis as it is currently the fastest way to build and deploy decentralized apps on a lot of blockchain such as Ethererum, BSC, Solana and Elrond. Furthermore, decentralized applications that use Moralis are cross-chain by default which means that in the event that a new blockchain is invented, the deployed app will instantly work on any chain thus making it future proof. Additionally, any decentralized app that is built with moralis comes with a Moralis Server together with the Moralis SDK which allows developers to quickly create their decentralized applications with user authentication and blockchain data such as user token balances and transactions without writing much code. Figure 3 shows the database for BloX System.

objectId	emailVerified	ACL	updatedAt	authData	username	createdAt	password	email	accounts
GgdkCp71vGFH4IV...	(undefined)	GgdkCp71vGFH4IV...	9 July 2022 at ...	{"moralisEth":{...	VJeaVmxKpDIHQ1Y...	9 July 2022 at ...	(hidden)	(undefined)	["0xa5069543a4...
3ubbbPzCctFZoemL...	(undefined)	3ubbbPzCctFZoemL...	10 July 2022 at ...	{"moralisEth":{...	SQfzD168Zzahi4F...	9 July 2022 at ...	(hidden)	(undefined)	["0xe733f6d6665...
xjTGjK0eiRHEuz...	(undefined)	role:coreservic...	6 July 2022 at ...	(undefined)	coreservices	6 July 2022 at ...	(hidden)	(undefined)	(undefined)

Fig. 3. Moralis Database

This section will include some screenshots of the BloX prototype system. Upon clicking the login or register button, a MetaMask window will open up as shown in Figure 4 which asks the user to connect their MetaMask wallet to the website to access all the functionalities. If they fail to authenticate through MetaMask then the user will not be able to access the website. If their MetaMask is connected, it will show the time and date of when the user accessed the website on the Moralis database.

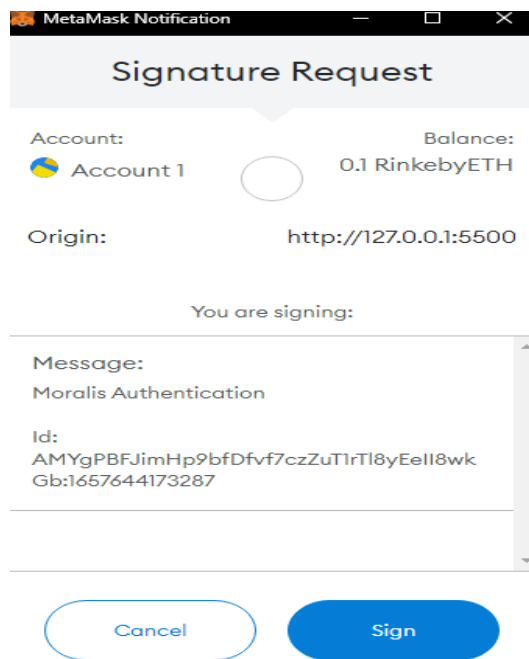


Fig. 4. MetaMask Authentication Pop-up

Figure 5 shows the live cryptocurrency price tracker. It updates dynamically every 10 seconds. Currently, it only shows 5 cryptocurrencies which are Bitcoin (BTC), Ethereum (ETH), Dogecoin (DOGE), Ripple (XRP) and Shiba Inu (SHIB). Among the information that is available in the price tracker is the current price of the cryptocurrency, the percentage change pricewise in the last 24 hours, the 24 hours volume and the current market volume of the cryptocurrency. All of the data is being pulled using the CryptoCompare API.

Coin	Price	24h %	24h Volume	Market Cap
Bitcoin BTC	\$20,849.98	5.70%	\$45,931.90	\$398,113,166,866.50
Ethereum ETH	\$1,218.04	12.72%	\$651,700.59	\$148,059,521,131.12
Dogecoin DOGE	\$0.06	6.12%	\$526,060,228.31	\$8,584,246,818.77
Ripple XRP	\$0.34	7.78%	\$264,583,880.21	\$33,806,461,831.51
Shiba Inu SHIB	\$0.000011	6.96%	\$2,497,940,871,529.13	\$6,433,331,740.21

Fig.5. Live Cryptocurrency Price Tracker

After clicking the link in the transaction history page, the user will be brought to the page as shown in Figure 6 and see their transaction live on the blockchain. They can view the status of the transaction in real time. There is also several useful information provided such as the transaction hash.

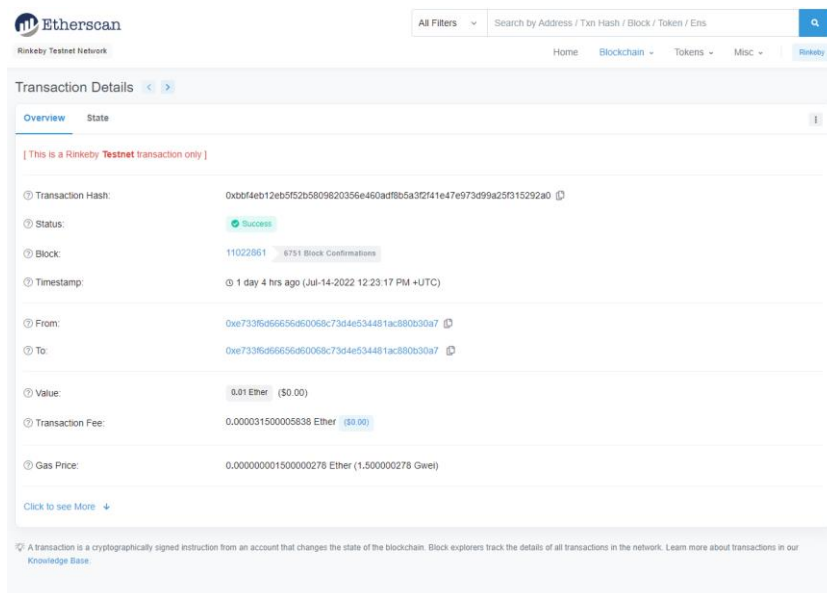


Fig. 6. Transaction Details Page

On the transfer ETH page as shown in Figure 7, there is two text fields that the user must fill in before they can transfer crypto. The first field is the amount of crypto they want to transfer, and the second field is the wallet address of the receiver. After both fields are filled, the user can click the "Transfer!" button to finally transfer their cryptocurrency.

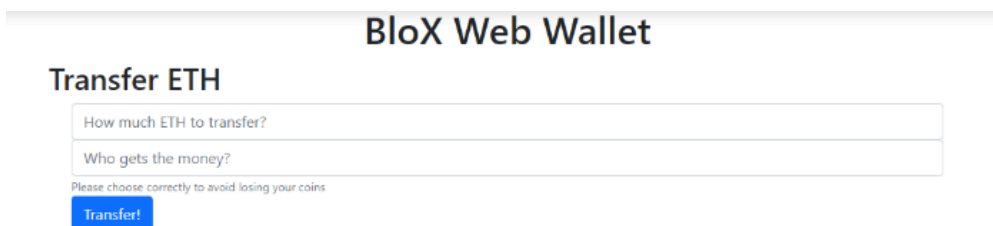


Fig. 7. Transfer ETH Page

When the user clicks the "Transfer!" button, a MetaMask alert will be shown as in Figure 8 will asks user to reject or confirm the transaction. In the pop-up there will be details about the transfer such as how much gas fee the transaction will require and the total amount of crypto that will be taken from the user.

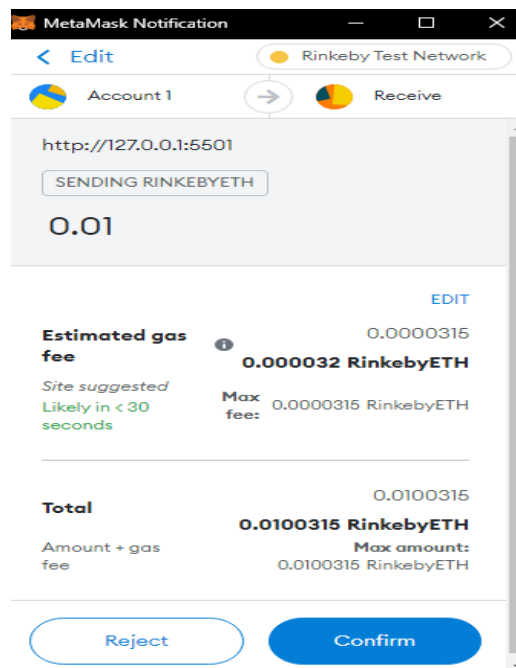


Fig. 8. Reject or Confirm Transaction Page

After the development and implementation of the prototype system, the system shall go through evaluation. Furthermore, software testing would also be conducted in order to test the system which is comprised of system testing and user acceptance testing. The method through which a quality assurance (QA) team assesses how the various components of an application interact with one another in the entire, integrated system or application is known as system testing, also known as system-level testing or system-integration testing. System testing makes sure an application works as intended. This procedure, which functions as a form of black box testing, focuses on an application's functionality. For instance, system testing may examine whether each type of user input results in the desired output throughout the application. A QA team determines if an application satisfies all of its requirements including technical, business, and functional requirements through system testing. The QA team may use many test kinds, including as performance, usability, load testing, and functional tests, to achieve this [19-21]. User acceptance testing is done in order to determine if the system meets all of the requirements needed by users. User acceptance testing (UAT), commonly referred to as beta testing or end-user testing, is the process of having users or clients test software to see if they can accept it or not. Once the functional, system, and regression testing is finished, this is the last testing carried out. This testing's primary goal is to confirm that the software meets the necessary standards. End users that are familiar with the requirements perform this validation [22-25].

6. Conclusion

The paper has discussed the need for a decentralized financial system in the form of cryptocurrency wallet and proposed such system. A system has been developed and implemented and system testing evaluation shows the system is working as intended. The project has met all the research objectives that was required through the development of the system.

However, there are still many limitations present in the current research. First of all is that the sample size and demographics of the questionnaire were too broad and thus it may not be an accurate representation of the general public. Furthermore, there are still a handful of quirks and

bugs that are present in the system such the mobile unresponsiveness of the website. Not only that, all of the cryptocurrency transaction taking place in the system is based off the Rinkeby Ethereum in the Rinkeby Testnet Network. Simply put, all of the transactions are using "fake" Ethereum and not the real one. Furthermore, the cryptocurrency price tracker currently only tracks the price movement of five cryptocurrencies which are Bitcoin, Ethereum, Ripple, DogeCoin and Shiba Inu. Some of the recommendations for future works are making the main cryptocurrency wallet more attractive for users to use. With the current state of the wallet right now, it might not attract users to use it as the design is very simple and not that interactive. Besides that, implement real cryptocurrencies. Since the current system is just a prototype, the cryptocurrency transaction is based on Rinkeby ETH which is a fake version of Ethereum which holds no value. It is hoped that in the future, the system will be able to add real cryptocurrency to its platform.

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References

- [1] Hisham, Sabri, Mokhairi Makhtar, and Azwa Abdul Aziz. "Combining multiple classifiers using ensemble method for anomaly detection in blockchain networks: A comprehensive review." *International Journal of Advanced Computer Science and Applications* 13, no. 8 (2022). <https://doi.org/10.14569/IJACSA.2022.0130848>
- [2] Wahab, Siti Norida, Nurhidayah Bahar, and Nur Azirah Mat Radzi. "An inquiry on knowledge management in third-party logistics companies." *International Journal of Business Innovation and Research* 24, no. 1 (2021): 124-146. <https://doi.org/10.1504/IJBIR.2021.111977>
- [3] Ahmad, Sabrina, and Siti Azirah Asmai. "Measuring software requirements quality following negotiation through empirical study." *International Journal of Applied Engineering Research* 11, no. 6 (2016): 4190-4196.
- [4] Abdurrahman, Jalil, Martin Beer, and Paul Crowther. "Pedagogical requirements for mobile learning: A review on MOBIlearn task model." *Journal of Interactive Media in Education* 2015, no. 1 (2015): 1-17.. <https://doi.org/10.5334/jime.ap>
- [5] Kolandaisamy, Raenu, Seow Li Lie, Indraah Kolandaisamy, Abdurrahman Bin Jalil, and Geetha Muthusamy. "The Impact and Effectiveness of E-Wallet Usage for Malaysian Male and Female." *Specialusis Ugdymas* 1, no. 43 (2022): 4102-4109.
- [6] Zamri, Numadiyah, Zarina Mohamad, Wan Nor Shuhadah Wan Nik, and Aznida Hayati Zakaria Mohamad. "Smart Secure Telerehabilitation Apps for Personalized Autism Home Intervention Using Blockchain System." *Blockchain for 5G-Enabled IoT: The new wave for Industrial Automation* (2021): 377-398. https://doi.org/10.1007/978-3-030-67490-8_15
- [7] Sulaiman, R. Aduni, Dayang NA Jawawi, and Shahliza Abdul Halim. "A dissimilarity with dice-jaro-winkler test case prioritization approach for model-based testing in software product line." *KSI Transactions on Internet and Information Systems (TIIS)* 15, no. 3 (2021): 932-951. <https://doi.org/10.3837/tiis.2021.03.007>
- [8] Jennah, H. U. X. L. E. Y. "CRYPTOASSETS IN ASIA Consumer attitudes, behaviours and experiences-December 2019." (2019).
- [9] Wahab, Siti Norida, Yi Ming Loo, and Chee Seng Say. "Antecedents of blockchain technology application among Malaysian warehouse industry." *International Journal of Logistics Systems and Management* 37, no. 3 (2020): 427-444. <https://doi.org/10.1504/IJLSM.2020.111414>
- [10] Nejad, Maryam Yousefi, Gabriel Lee Yung, Jaizah Othman, Aza Azlina Md Kssim, Ahmed Sarwar Khan, Fandy Lim Md Daniel Lim, and Premm Enbasakaran. "Factors Influencing Cryptocurrency Awareness Among Young Working Adults in Malaysia: A Conceptual Paper." *Malaysian Journal of Social Sciences and Humanities (MJSSH)* 7, no. 6 (2022): e001555-e001555. <https://doi.org/10.47405/mjssh.v7i6.1555>
- [11] Levy, A. "Coinbase gets reference price of \$250 per share from Nasdaq ahead of today's direct listing," CNBC, 14-Apr-2021.
- [12] Bahar, Nurhidayah, Siti Norida Wahab, and Nor Diana Ahmad. "Understanding challenges faced in online teaching and learning among Malaysian universities' instructors during COVID-19 pandemic." In *2020 Sixth International Conference on e-Learning (econf)*, pp. 154-157. IEEE, 2020. <https://doi.org/10.1109/econf51404.2020.9385474>

- [13] Azizam, Shahzool Hazimin, Syarilla Iryani Ahmad Saany, Eimir Azli Md Noh, Nik Azman Nik Hashim, Muhammad Waqas, and Yousef A. Baker El-Ebiary. "Blockchain as a secure and decentralized communication tool for future sustainable development." *PalArch's Journal of Archaeology of Egypt/Egyptology* 17, no. 9 (2020): 942-953.
- [14] Levy, D. "Social Trading Company eToro expands offices," CTECH.-Oct-2019.
- [15] Pendharkar, Parag C., James A. Rodger, and Girish H. Subramanian. "An empirical study of the Cobb–Douglas production function properties of software development effort." *Information and software technology* 50, no. 12 (2008): 1181-1188. <https://doi.org/10.1016/j.infsof.2007.10.019>
- [16] Bahar, Nurhidayah, Siti Norida Wahab, and Mahfuzur Rahman. "Impact of knowledge management capability on supply chain management and organizational practices in logistics industry." *VINE Journal of Information and Knowledge Management Systems* 51, no. 5 (2021): 677-692. <https://doi.org/10.1108/VJKMS-02-2020-0022>
- [17] Sulaiman, Rabatul Aduni, Dayang Norhayati Abang Jawawi, and Shahliza Abdul Halim. "Classification Trends Taxonomy of Model-based Testing for Software Product Line: A Systematic Literature Review." *KSII Transactions on Internet and Information Systems (TIIS)* 16, no. 5 (2022): 1561-1583. <https://doi.org/10.3837/tiis.2022.05.008>
- [18] Sulaiman, Rabatul Aduni, Dayang Norhayati A. Jawawi, and S. A. Halim. "Coverage-based approach for model-based testing in Software Product Line." *Int. J. Eng. Technol* 7, no. 4 (2018): 63-68. <https://doi.org/10.14419/ijet.v7i4.15.21373>
- [19] Asmai, Siti Azirah, Z. Zainal Abidin, and Mohd Ali MH Nizam AFNAR. "Aedes mosquito larvae recognition with a mobile app." *Int J Adv Trends Comput Sci Eng* 9 (2020): 5059-65. <https://doi.org/10.30534/ijatcse/2020/126942020>
- [20] Shu Qian, Gan, Ammar Ashraf Bin Narul Akhla, Chee Ling Thong, Abdul Samad Shibghatullah, Su Mon Chit, Lee Yen Chaw, and Chiw Yi Lee. "A comparative study of navigation API ETA accuracy for shuttle bus tracking." In *International Conference on Human-Computer Interaction*, pp. 446-461. Cham: Springer International Publishing, 2022. https://doi.org/10.1007/978-3-031-05014-5_37
- [21] Asmai, S., M. N. D. M. Zukhairin, A. Jaya, A. F. N. A. Rahman, and Z. Abas. "Mosquito larvae detection using deep learning." *International Journal of Innovative Technology and Exploring Engineering (IJITEE)* 8, no. 12 (2019): 804-809. <https://doi.org/10.35940/ijitee.L3213.1081219>
- [22] Salleh, Muhammad Sharilazlan, Siti Azirah Asmai, Halizah Basiron, and Sabrina Ahmad. "A Malay Named Entity Recognition using conditional random fields." In *2017 5th international conference on information and communication technology (ICOICT)*, pp. 1-6. IEEE, 2017. <https://doi.org/10.1109/ICOICT.2017.8074647>
- [23] Akhla, Ammar Ashraf Narul, Chee Ling Thong, Abdul Samad Shibghatullah, Su Mon Chit, Aswani Kumar Cherukuri, Lee Yen Chaw, and Chiw Yi Lee. "Impact of real-time information for travellers: A systematic review." *Journal of Information & Knowledge Management* 22, no. 01 (2023): 2250065.
- [24] Xiin, Loh Giin, Abdul Samad Shibghatullah, Abdurrahman Jalil, and Mohd Helmy Abd Wahab. "DriverSeekers-A mobile designated driver services system." In *Journal of Physics: Conference Series*, vol. 1874, no. 1, p. 012029. IOP Publishing, 2021. <https://doi.org/10.1088/1742-6596/1874/1/012029>
- [25] Vivilyana, Viva, Poh Soon JosephNg, Abdul Samad Shibghatullah, and H. C. Eaw. "JomImage: Weight control with mobile snapfudo." In *Intelligent Systems and Applications: Proceedings of the 2020 Intelligent Systems Conference (IntelliSys) Volume 3*, pp. 168-180. Springer International Publishing, 2021. https://doi.org/10.1007/978-3-030-55190-2_13