Interim Report

A Blockchain Payment System in Enhancing Hong Kong Philanthropy Transparency

Hui Jing Tung Bernice (3035952991)
Wu Hoi Ching (3035931208)

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Supervisor: Prof. Yiu Siu Ming

Abstract

The lack of regulation and low transparency among charities in Hong Kong has led to multiple fund misappropriation scandals, resulting in public distrust and credibility issues. In this context, charitable organizations often struggle to provide donors with clear visibility into how their contributions are used, making it difficult to identify trustworthy entities. To address these challenges, this project proposes a blockchain-based payment system for donation tracking in Hong Kong. By enhancing transparency, accountability, and trust, and ensuring that funds are used appropriately, the system aims to increase donor confidence and attract more support for local charities. Given that it may take time for the government to establish effective regulations, this blockchain solution can help build trust and accountability in the interim. The development of a prototype for the blockchain system, along with an evaluation using questionnaires, is a key focus of this work. Progress has been made, with the literature review completed, the front-end workflow and back-end donation flow finalized, and the user interface design currently ongoing. Next steps involve refining the prototype and preparing for the evaluation phase to assess the system's effectiveness.

Acknowledgements

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Contents

List of Figures

List of Tables

1. Introduction

1.1 Background

Philanthropy originated from the Greek word “philanthropia”, which means love of mankind (National Philanthropic Trust, 2016). It is defined as “private giving for public purposes” (Barman, 2017, p.272), and refers to the actions taken by a private citizen, or groups of citizens to improve the lives of those who are less fortunate or have special needs (Gonzalez, 2013). This practice of kindness and philanthropic organizations have been around since ancient times, and their legacy lives on in today's world.

Hong Kong is renowned for its rich history in philanthropy and tradition of giving. In 2019, there were more than 10,000 tax-exempt charities in Hong Kong with donations reached an unprecedented high over 18 years totaling HK$12.7 billion (Lau, 2020). Being a highly philanthropic city, as shown in Figure 1.1 (Lau, 2020), the number of registered charities for tax exemption and public donations has surged in recent years. Hong Kong also ranked 18th out of 146 in a global ranking of propensity to donate in 2018 (Lau, 2020).

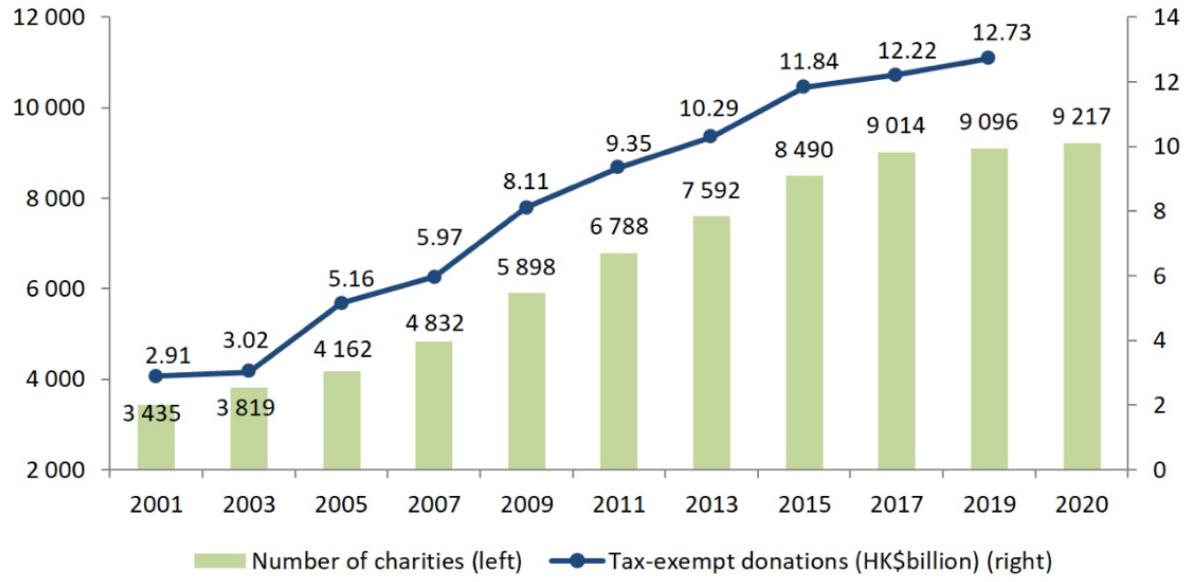

Figure 1 Charities and tax-exempt donations in Hong Kong (Lau, 2020)

Despite the high volume of philanthropic activities, there is currently no official registration system for charitable organisations in Hong Kong (The Law Reform Commission of Hong Kong, 2024), and no law or single regulatory authority dedicated to charities (Lau, 2020). Charitable organizations generally have the freedom to report whatever they consider appropriate, and are not required to disclose details about their charity programs, internal

controls, or how senior executives utilize funds (Young, 2024). This absence of oversight and transparency has led to instances of misconduct within charitable organizations, resulting in inflated administrative and operational expenses. For instance, news reported that Save the Children Hong Kong allocated 30% of donations towards administrative costs (Yahoo, 2023), whereas the CEO of the Hong Kong Sheng Kung Hui Welfare Council reportedly received an annual salary of $3.12 million (Cheung, 2023).

1.2 Motivation

When it comes to charitable donations, mismanagement, lack of transparency and non-disclosure of information can be detrimental to all stakeholders (Arshad, R., 2015). The high-profile scandals mentioned above erode donor trust towards the whole sector, raising public concerns and undermining the credibility of charitable organizations in Hong Kong. Consequently, donors are unable to ascertain the destination of their contributions, leading to declining trust in charitable giving (Hyndman, N et al., 2016) and negatively impacting the philanthropic landscape of Hong Kong, perpetuating a vicious cycle of distrust and inefficiency. To address this, a more transparent and accountable system is needed for charitable organizations in Hong Kong. This project aims to change the traditional mechanisms of charitable giving by building a blockchain-based system for local charities in Hong Kong.

1.3 Objectives, scope and deliverables

To address the problems identified above, this project aims to propose a blockchain-based payment system for charitable organizations in Hong Kong to enhance transparency, accountability, and trust in local charities. This project aims:

1. To foster a higher degree of transparency and trust among stakeholders in the charitable donation process by making donations traceable to all parties through blockchain system.
2. To provide accountability for stakeholders by using smart contracts to authorize designated individuals to receive funds and mitigating the risk of unauthorized transactions.

The scope of this project contains four key parts, the development of a blockchain framework for real-time donation tracking, the implementation of smart contract and digital signature mechanism for transaction accountability, the design of the system's user interface, and the evaluation of the system's effectiveness.

1.4 Project contribution

The proposed blockchain-based payment system aims to address the unique challenges faced by local charities in Hong Kong, particularly in the absence of specific regulations governing their operations. Without clear standards and rules, charities struggle to provide donors with clear visibility into how their contributions are utilized, making it difficult for donors to identify trustworthy ones to support. Trust is crucial in philanthropy, and lack of trust leads to a reduction in available funds, hindering charities' ability to fulfil their missions in impacting the community. Considering that it may take time for the government to establish effective regulations for charities, this blockchain system can help build trust and accountability during the interim. It ensures that funds are used appropriately and fosters greater donor confidence in local charities. Additionally, the system would be especially beneficial for small and medium-sized local charities, which often face difficulties in gaining visibility and building trust. By enhancing their credibility, the system can attract more support for these organizations.

1.5 Report outline

The remaining part of this paper will be as follows. Chapter 2 presents a detailed literature review to understand existing studies and solutions. Chapter 3 states this project's methodology. Chapter 4 reviews the current progress of this project, and limitations encountered. Chapter 5 states the schedule and future plan of the project. Chapter 6 concludes the project, reflecting the overall contribution of the project.

2. Literature review

The purpose of this review is to provide a better understanding of blockchain's potential applications in enhancing transparency and accountability of charitable donations in Hong Kong. It will explore the unique features of blockchain that address existing challenges within the local philanthropic landscape and review existing blockchain-based donation studies and solutions.

2.1 Blockchain

To achieve a high level of transparency and trust among the parties involved in charitable donation processes, it is imperative that donations are traceable by all parties involved. Blockchain is suitable for achieving transparency and accountability (Hu et al., 2020) in contrast to current donation methods such as fund grant and cash payment.

Blockchain is a distributed data structure that securely links blocks of information in chronological order through cryptographic methods (El-Rewini et al., 2020). A major component of blockchain is smart contracts, which are self-executing agreements stored on the blockchain (International Business Machines Corporation, 2024). They play a crucial role by automatically enforcing terms once predefined conditions are met. This eliminates the need for intermediaries, streamlining transactions and reducing delays.

The key features of blockchain further enhance its functionality. Its immutability ensures that data cannot be altered once recorded, providing a reliable history of transactions. Transparency is another significant benefit, as all participants can access the ledger of transactions that are verifiable and traceable. Given these strengths, blockchain presents a compelling solution for charity donation platforms, effectively addressing the critical issues of transparency and trust in the management of funds. Research by Charities Aid Foundation (CAF) has shown decentralized characteristic of blockchain makes it a promising solution for managing charity donations in a more transparent and effective way (R. Davies, 2018).

2.2 Existing studies and solutions

Many recent studies on blockchain-based donation tracking systems, indicating a growing interest in how this technology can enhance the donation process. One study by Lee et al. (2018) found that blockchain systems can significantly improve transparency, security, and efficiency in the donation process. Another study suggests that blockchain can address the trust and accountability challenges faced by charitable organizations (Christie, 2020).

Some studies have also proposed comprehensive frameworks for blockchain-based donation tracking systems. Table 1 below shows three systems proposed by different papers, what stakeholders they involved, and the features that enable transparency and accountability in their proposed systems.

Table 1 Existing blockchain-based donation systems

Paper	System	Stakeholders	Transparency and Accountability Features
Smart Donations: Event-Driven Conditional Donations Using Smart Contracts On The Blockchain (Trotter et al., 2020)	• Private Permissionless Ethereum Blockchain • Mobile app	• Donor • Trustees • Beneficiary • Validators	• Mobile app real-time tracking • Smart contract • Escrow system
Blockchain-based donations traceability framework (Almaghrabi & Alhogail, 2022)	• Public Permissioned Ethereum Blockchain • Web page	• Donor • Needy party • Trustee	• System grants specific functions to authenticated parties • Tracing feature reveals each case's status, donation amount, and by whom it is being managed
Smart Blockchain Networks: Revolutionizing Donation Tracking in the Web 3.0 (Nairi et al., 2024)	• Ethereum Blockchain • Web page	• Donation event owner • Donor • Validators	• Transaction ID for tracking • Smart contract • Escrow system

The framework suggested by Nairi et al. (2024) integrates transparency, traceability, and an escrow mechanism. Each donation is assigned a unique transaction identity to enable tracking of funds. Through recording transaction details on the blockchain, the system ensures real-time

updates and transparency. Moreover, the escrow system safeguards the donations, releasing funds only when predefined conditions are met by the beneficiaries (Nairi et al., 2024).

In sum, previous research shows that blockchain technology has the potential to transform the tracking and management of donations in the non-profit sector.

Looking at real-life applications, several blockchain donation systems are currently available in the market. For instance, Binance Charity utilizes smart contracts to ensure that donations are allocated for their intended purposes, providing donors with real-time updates on their contributions' impact (Nairi et al., 2024). Some international charities have also started accepting cryptocurrencies as a method of donation. However, even large local charities in Hong Kong, such as the Community Chest of Hong Kong, do not accept cryptocurrencies, and there are no platforms available for donors to track their donations. There are not many studies specifically focusing on blockchain solutions for donations within the Hong Kong context as well. Therefore, this research will work to combine previous findings with local insights, concentrating on developing a blockchain payment system tailored for Hong Kong charities.

3. Methodology

This chapter presents the methodology to be employed in developing the blockchain-based payment system for local charitable organizations. The following sections will cover the two stage methodologies implemented in the project. The first stage will be the development of the blockchain system prototype (Section 3.1), the second stage will be a performance analysis of our system (Section 3.2).

3.1 Prototype development

To develop a prototype for the proposed blockchain payment system, two main components will be required: the system framework, which includes user-related functions and journey, as well as the blockchain system workflow and architecture; and the user interface design of the payment system.

A high-level overview of our project workflow is shown in Figure 2. The workflow is broken down into 3 user parties — Donors, Beneficiary and Trustee. Trustee is referred to as an organization within the blockchain system that has the list of Beneficiary. The charity donation chain begins with the donor and ends with the beneficiary party which will be elaborated in the following.

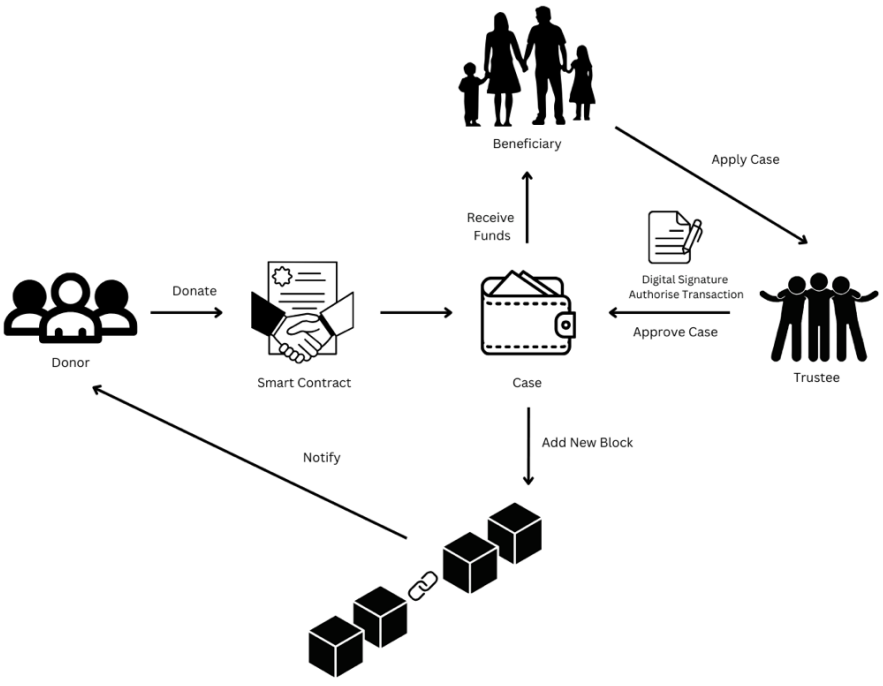

Figure 2 High-level overview of project workflow

This workflow is built on a public-permissioned blockchain where only verified participants are allowed to join the network, ensures the authenticity of user identities (Almaghrabi & Alhogail, 2022). Each user is an account holder with a cryptocurrency wallet in the blockchain network and each of them can be uniquely identified in the network through their account address. Any participants who want to join the network will require validation of their information to prevent fraudsters.

The charity donation chain begins with the donor donating through a smart contract. This contract will store and execute the predefined conditions agreed upon by the donor, no central authority or third-party will be involved for the execution (Ølnes, S et al., 2017) providing a trust layer to the donor. The beneficiary will apply case to the trustee through the system, and if the beneficiary conditions meet the smart contract, the trustee will approve the application with a digital signature to ensure accountability for the organization. Transfer of funds will be recorded on the blockchain, allowing donors to verify how their donations are utilized by specific charities (Trustee) or projects (Case). Additionally, only designated individuals will have the authority to approve fund transfers, reducing the risk of unauthorized transactions. The system enables real-time traceability, allowing donors to track their contributions throughout all stages of the donation process.

Donors can donate, track their contributions, and access information about transaction histories and accountability. Trustees will have the ability to trace donations, create cases, approve or reject requests from the needy, and withdraw funds. Meanwhile, the beneficiary can create cases and request withdrawals, subject to approval from the trustee. This comprehensive design ensures transparency and accountability within the donation process.

3.2 Performance evaluation

The performance analysis will involve an evaluation of the blockchain system's impact on transparency, accountability, and trust within the charity sector. To gather insights from donors and relevant stakeholders, questionnaires focused on their experiences and perceptions of the system will be distributed, specifically targeting users in Hong Kong. This evaluation will allow us to gather feedback from a diverse range of end users and identify areas in the system that require tuning, particularly regarding usability and functionality. Additionally, comparisons with other donation systems will be conducted to assess relative effectiveness. Incorporating valuable insights into system enhancement will help ensure that our system meets the needs and satisfies the expectations of our target audience.

4. Current Progress and Challenges

This chapter outlines the current progress of the project. A comprehensive system structure has been developed, which includes a user functions table, system's front-end flow and back-end donation flow. The challenges encountered during the project will be addressed in Section 4.2.

4.1 Current Progress

4.1.1 Users' roles

A comprehensive system should be capable of performing multiple functions to accommodate all users' needs. The functions outlined in Table 2 were identified through literature review and an analysis of the framework proposed previously.

Table 2 User functions in system

Donor	Charity	Beneficiary
Browse charities and programmes	Set up donation programmes	Create Account
Exchange fiat money to digital assets when donating	Approve beneficiary applications	Validate identify by uploading personal information
Donate using smart contract template provided	Issue Smart Contract templates for donation programmes	Apply for program eligibility (approved by Charity)
Track donation	Track programmes and monitor donations	Check status

4.1.2 Front-end workflow

A front-end flowchart of the system is shown in Figure 3. Upon accessing the system's homepage, users are required to log in using their credentials to ensure security and prevent fraudulent activities. New users must first register and specify their roles as Donor, Beneficiary or Trustee. The registration process and subsequent functionalities are role specific.

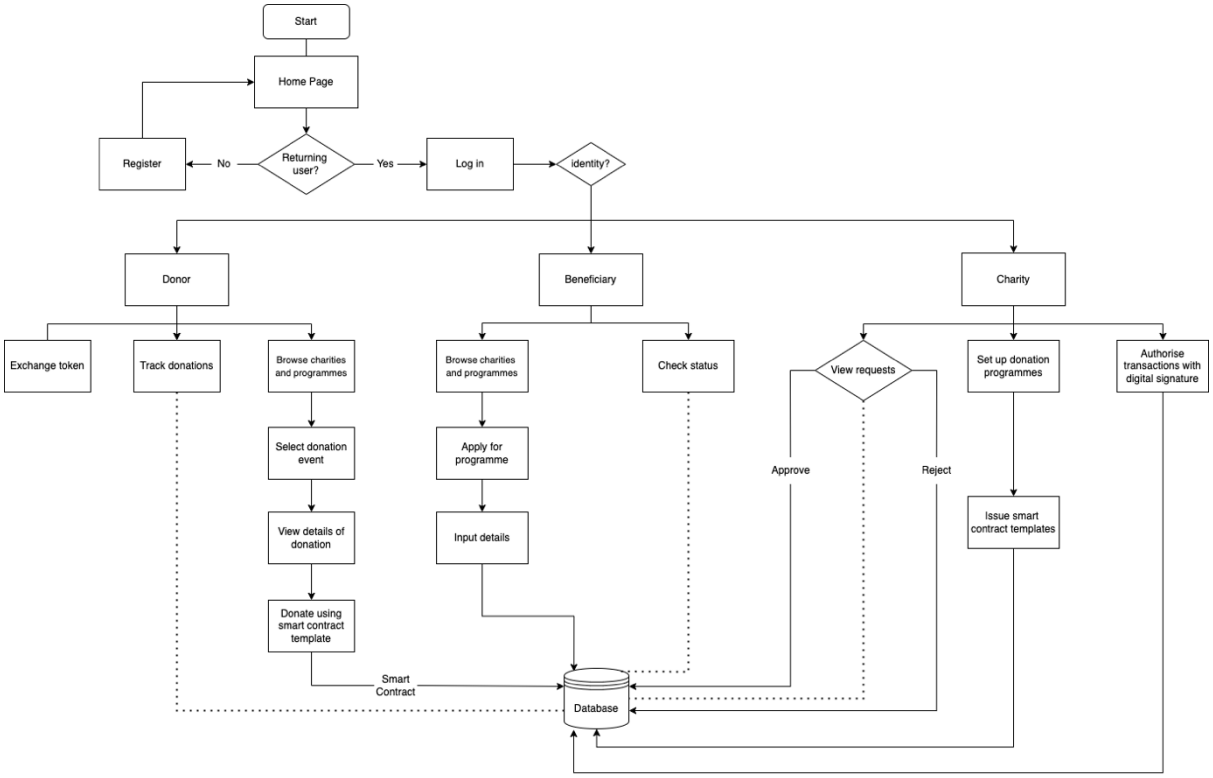

Figure 3 Front-end flowchart of system

Following a successful login, donors can navigate through available charity cases and view detailed information. If a donor chooses to contribute, they will exchange tokens and donate using the smart contract template offered by the charity. This contract functions as an immutable ledger, recording key details such as the donor's account information and the donation amount. The smart contract is stored in the case database, enabling donors to track their contributions by accessing the relevant records.

Beneficiaries can apply to opt into a program when they meet the criteria of an existing program, subject to the charity's approval. To verify, they must provide various sets of information, including address, income, and age. Data is securely stored in the case database, allowing beneficiaries to monitor the status of their applications directly through the system.

The charity will either approve or reject requests submitted by beneficiaries after evaluating the documents. Their decisions are subsequently recorded in the database, and notifications are sent to inform the applicants of the outcomes. The charity is also responsible for setting up donation programs and smart contract templates, as well as constantly monitoring donations. For authorizing transactions, the charity will append a digital signature to ensure accountability.

4.1.3 Back-end donation flow

Figure 4 shows the back-end donation flow designed, illustrating the donation process through the proposed system. There are two paths: one for donors and one for charities.

For charities, when setting up the donation programme, they will need to create a smart contract template for that specific programme. The template may include fields such as the donation amount, conditions set for the donation, donor address, recipient address, and transaction deadline.

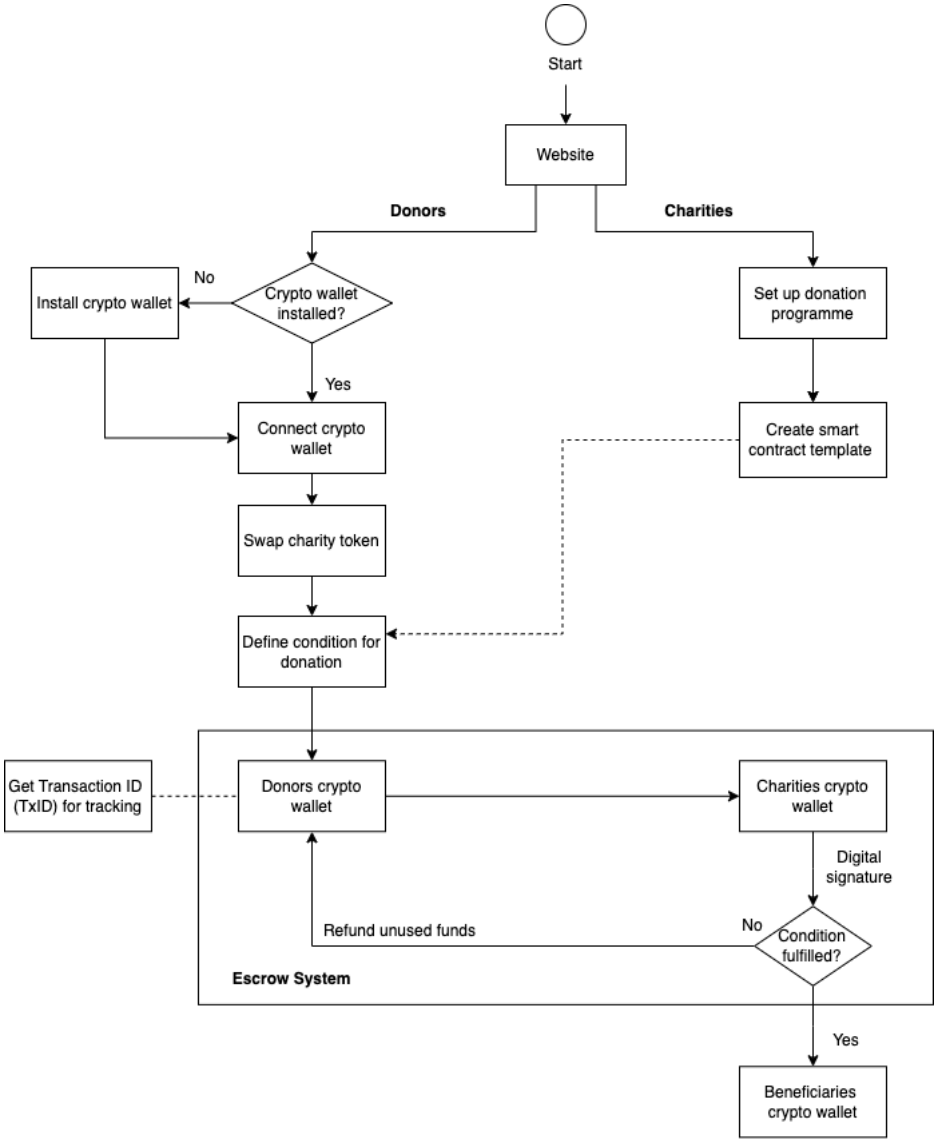

Figure 4 Back-end donation flow of system

As for donors, after selecting the donation programme, they will first be prompted to check if a crypto wallet is installed. Once connected to their crypto wallet, they can swap charity tokens for donation use. They can then use the smart contract template provided by the charities to

define the conditions for donation. When the token is transferred from the donors' crypto wallet to the charities' crypto wallet, the donation is made, and a transaction ID (TxID) is provided to the donor for real-time tracking.

Inside the escrow system, when charities would like to transfer the funds, they must authenticate with a digital signature through the system. The system will then check if the defined conditions are fulfilled. If they are, the funds will be sent to the designated beneficiaries' crypto wallet. Conversely, if the conditions are not met, the funds will be refunded back to the donors' crypto wallet. This helps to ensure that funds go exactly where the donors intend them to.

4.1.4 User Interface

Based on the backend system design, the user interface of the webpage is intended to facilitate user interactions with the donation system. The home page in Figure 5 features a header that provides navigation to key pages, including "About Us" for background information, "Charities" to showcase all participating charities, "Donation Events" to view ongoing donation opportunities, and a "Log In" button. The "Learn more" button also directs users to the "About Us" page.

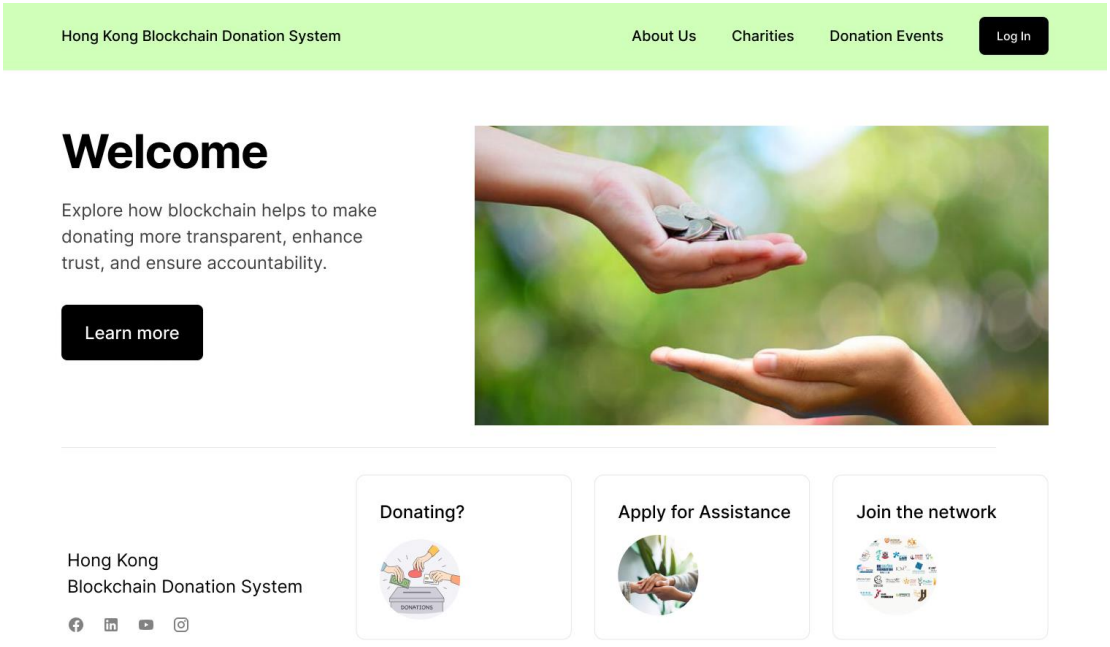

Figure 5 Home page of website

At the bottom of the page, three interactive boxes are consistently displayed, directing users to the registration page: "Donating?" for donors, "Apply for Assistance" for those in need, and "Join the Network" for charities.

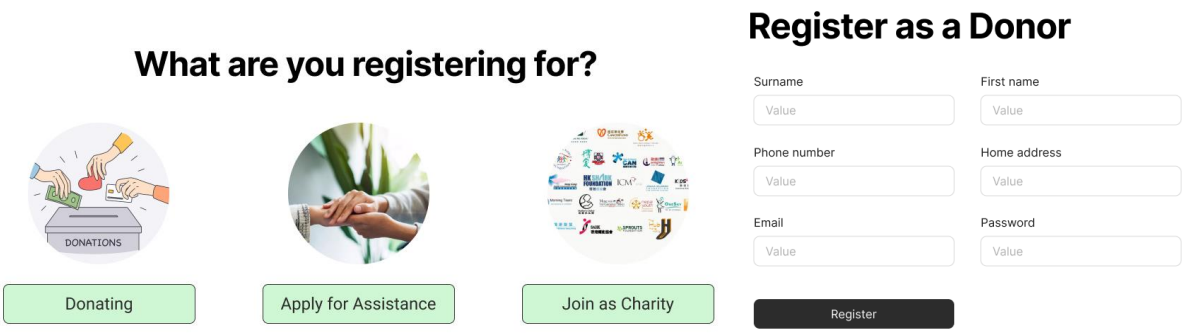

Figure 6 Registration page of website

As illustrated in Figure 6, the registration page allows users to register as a donor, a beneficiary, or a charity. For example, when users select “Donating”, they will be taken to the “Register as a Donor” page, where they are prompted to provide personal information, such as their surname and phone number.

Additionally, as shown in Figure 7, the donation events page displays events along with their title and purpose. It also includes a search bar, allowing users to find relevant information easily.

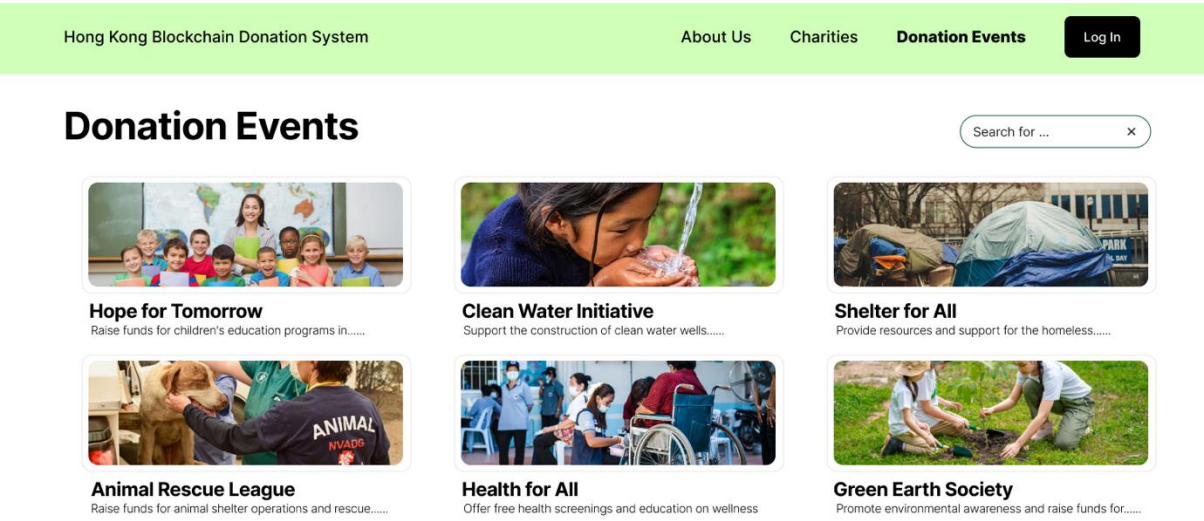

Figure 7 Donation events page of website

A few pages, such as the Charities page and the Track Donations page, are still in development. Nonetheless, this user interface design aims to improve user experience by providing intuitive navigation and access to key features. It seeks to facilitate engagement for all users, potentially enhancing participation and transparency in the donation process.

4.2 Challenges

Although the system’s flowchart and backend architecture have been successfully developed, several limitations and challenges have been identified during the project.

4.2.1 Blockchain Consideration

The first challenge pertains to the choice of blockchain for our system. A public permissioned blockchain offers greater transparency, which is crucial for fostering donor confidence, while a private permissionless blockchain provides stronger credibility and privacy. Transparency was of utmost priority for fostering donor confidence yet ensuring it without compromising credibility and data security was complex. Given the project’s limited timeframe, extensive research into hybrid blockchain architecture is imperative to adapt to evolving needs, ensuring scalability and flexibility without compromising transparency or performance.

4.2.2 Consensus Mechanism

The second challenge involves selecting the most suitable consensus mechanism. While Proof-of-Stake (PoS) offers higher efficiency and environmental sustainability compared to traditional mechanisms, its high cost and complexity may not achieve the same operational efficiency as regular database. On the other hand, relying on third-party or external validators simplifies the process but conflicts with blockchain's core principle of decentralization. This trade-off underscores the need to establish a comprehensive framework for evaluating and selecting the most appropriate consensus mechanism, which should align with the platform's objectives, ensuring a balance between efficiency, decentralization, and cost-effectiveness.

4.2.3 Need for Tokenization

The volatility of cryptocurrencies and the need for tokenization introduce another layer of complexity to the platform's design. Cryptocurrency volatility poses a significant challenge for charities relying on distributed ledger technology (DLT), as fluctuating token values can lead to unpredictable funds for charity. While creating a dedicated currency exchange mechanism offers greater control and flexibility, it also introduces additional operational complexity and costs. Alternatively, using existing cryptocurrencies simplifies implementation but exposes the platform to market volatility. To address these challenges, it is critical to explore the feasibility of integrating a trusted payment service provider.

5. Future Plans

5.1 Project Schedule

The project schedule outlined in Table 3 details the deliverables and milestones to be achieved in different stages.

Currently, the project is progressing on schedule, with focuses on finalizing the system design and drafting user questionnaires. Upon completion of these tasks, the project will shift its focus to system prototyping. This phase will involve the development of the blockchain infrastructure, implementation of the digital signature mechanism, and the visualization of the user interface. The prototype is planned for completion by February 2025, allowing sufficient time for performance evaluations and system adjustments scheduled for March and April 2025.

User testing feedback, collected through the questionnaire, will inform the refinement of the system. Following these adjustments, the prototype will undergo official deployment.

Table 3 Project schedule

Stage	**Periods**	**Deliverables and Milestones**
Phase 1: Inception	Aug. - Sep., 2024	Background research: • Local charity issues • Blockchain tracking system
		Phase 1 Deliverables: • ***Detailed project plan*** • ***Project webpage***
Phase 2: Elaboration	Oct., 2024	Literature Review: • Blockchain technology • Donation tracking systems
	Oct., 2024 - Jan., 2025	System Design: • User Interface • Workflow diagram • Backend architecture
		Performance Evaluation: • Draft questionnaire
		Phase 2 Deliverables • ***First presentation*** • ***Preliminary implementation*** • ***Detailed interim report***

Phase 3: Construction	Feb., 2025	Prototyping: • Blockchain • Digital signature mechanism • User interface
	Mar - Apr, 2025	Performance Evaluation and Adjustments: • Distribute questionnaire • Collect and analyse feedback • Adjustment on prototype
	Apr, 2025	***Phase 3 Deliverables*** • ***Finalized tested implementation*** • ***Final report*** • ***Final presentation***
		Project Exhibition

5.2 Next Steps

The next steps involve several key activities aimed at enhancing the prototype design. First, the backend system design will be refined to create a more detailed workflow. Additionally, the design for the remaining website pages will be completed, focusing on improving the overall user interface and experience, including the addition of categories for charities and events. Finally, preparations for the performance evaluation will be undertaken to ensure that the system meets its intended goals.

6. Conclusion

Over the years, the philanthropic landscape continues to grow and develop. However, the lack of regulations and oversight has led to instances of fraud and fund misallocation, eroding public trust in local charitable organizations. To address this pressing issue, this project proposes a blockchain-based payment system that aims to enhance transparency, trust, and accountability in charitable organizations. By providing real-time donation tracking, this system could potentially improve the overall transparency of charitable operations, thereby enhancing donor confidence and participation.

Following the completion of research and literature review, the design of the prototype has commenced. Initial designs for the backend system, including the system workflow and architecture, as well as the user interface designs, are mostly finished, providing a solid foundation for further development. Moving forward, challenges to be addressed include blockchain and consensus mechanism consideration and the need for tokenization. Nevertheless, potential strategies have been proposed to address these challenges, ensuring the successful implementation and evaluation of the system.

To keep the project on track, essential coding components will be prioritized, and clear evaluation metrics will be established to ensure the system meets the required standards.

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