Final Report (Individual)

A Blockchain Payment System in Enhancing Hong Kong Philanthropy Transparency

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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 evaluations on its effectiveness, is a key focus of this work.

Acknowledgements

We would like to express our deepest gratitude to our supervisor, Prof. Yiu Siu Ming, for his invaluable guidance, feedback, and support throughout this project. We would also like to express our appreciation to the Department of Computer Science for this opportunity to work on such an interesting topic.

Table of Contents

List of Figures

List of Tables

1. Introduction

1.1 Background

Philanthropy, derived from the Greek term "philanthropia" meaning love of mankind (National Philanthropic Trust, 2016), is defined as “private giving for public purposes” (Barman, 2017, p.272). It encompasses actions taken by private citizens or groups to enhance the lives of those less fortunate or with special needs (Gonzalez, 2013). This tradition of kindness and organized philanthropy has ancient roots and continues to shape the modern world.

Hong Kong has a strong philanthropic history. In 2019, over 10,000 tax-exempt charities operated in the city, with donations reaching a high of HK$12.7 billion over 18 years (Lau, 2020). As a highly philanthropic city, Hong Kong has seen a surge in registered charities for tax exemption and public donations in recent years, as shown in Figure 1 (Lau, 2020). In 2018, Hong Kong ranked 18th out of 146 in a global survey measuring the propensity to donate (Lau, 2020).

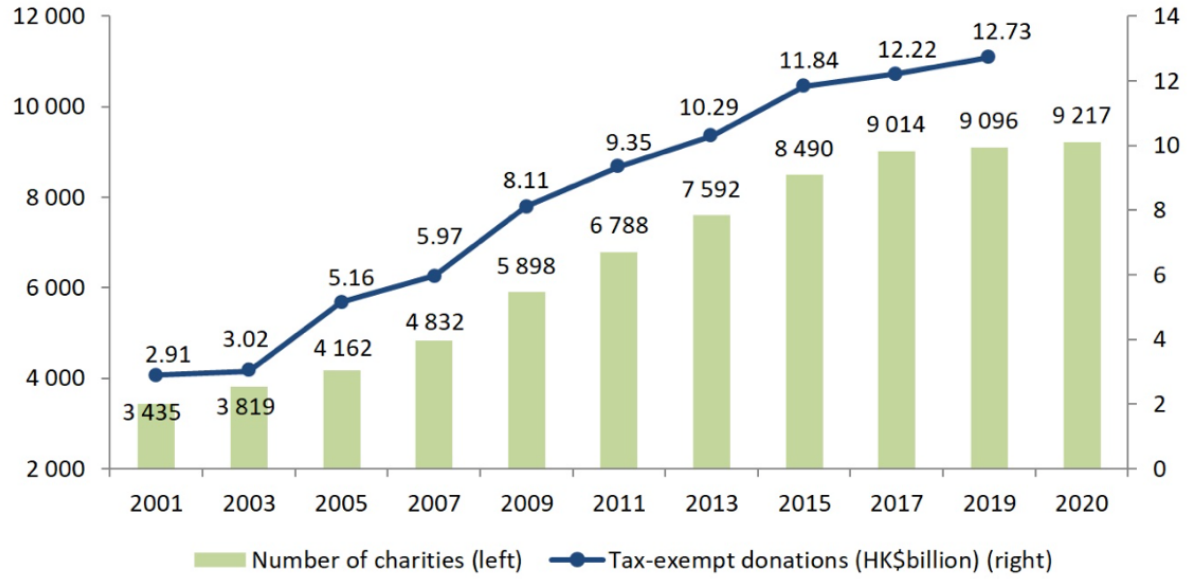


Figure 1 Charities and tax-exempt donations in Hong Kong (Lau, 2020)

Despite significant philanthropic activity, Hong Kong lacks a formal registration system for charitable organizations (The Law Reform Commission of Hong Kong, 2024) and a dedicated regulatory body or law governing them (Lau, 2020). Charities generally have the discretion to determine their reporting practices and are not obligated to disclose details regarding program specifics, internal controls, or executive compensation (Young, 2024). This lack of oversight and transparency has contributed to instances of misconduct, including inflated administrative

and operational costs. For example, reports indicate that Save the Children Hong Kong allocated 30% of donations to administrative expenses (Yahoo, 2023), while 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 referenced erode donor confidence, raising public concerns and damaging the credibility of Hong Kong's charitable sector. Consequently, donors struggle to determine how their contributions are utilized, leading to decreased trust in charitable giving (Hyndman, N et al., 2016). This negatively impacts Hong Kong's philanthropic landscape, creating a cycle of distrust and inefficiency. To combat this, a more transparent and accountable system is needed for charitable organizations in Hong Kong. This project aims to transform traditional charitable giving by creating 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 promote transparency and trust among stakeholders in the charitable donation process by enabling donation traceability through a blockchain system

2. To ensure accountability using digital signatures for authorizing transactions and providing donors with information about the responsible individual

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

1.4 Project contribution

This blockchain-based payment system is designed to tackle the specific challenges faced by Hong Kong's local charities, especially given the absence of tailored regulations. In the absence of specific standards, charities are often unable to provide donors with adequate transparency regarding fund utilization, thus impeding the identification of trustworthy organizations. Given the importance of trust in philanthropy, a lack thereof can result in reduced funding, thereby hindering the charities' capacity to fulfill their community-focused missions. As the establishment of effective governmental regulations for charities may require time, this blockchain system offers an interim solution for building trust and accountability. By ensuring appropriate fund allocation, increased donor confidence in local charities is fostered. Furthermore, the system is expected to be particularly advantageous for small and medium-sized local charities, which commonly experience difficulties in gaining visibility and establishing trust. Through enhanced credibility, increased support for these organizations can be attracted.

1.5 Report outline

The structure of the remaining of this paper will be as follows. Chapter 2 provides a comprehensive literature review to establish a foundation of knowledge regarding the technologies, existing studies, and solutions relevant to the project. Chapter 3 details the methodology employed in this project. The results and findings are presented in Chapter 4, along with a discussion of the limitations encountered and planned future work. Finally, Chapter 5 concludes the project by reflecting on its overall contribution.

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 and digital signature that address existing challenges within the local philanthropic landscape and review existing blockchain-based donation studies and solutions.

2.1 Blockchain

To ensure traceability of donations by all stakeholders, a high level of transparency and trust are required in charitable donation processes. Compared to traditional methods like fund grants and cash payments, blockchain is deemed suitable for achieving transparency and accountability (Hu et al., 2020).

Blockchain is defined as a distributed data structure in which blocks of information are securely linked chronologically through cryptographic methods (El-Rewini et al., 2020). Its operation is based on maintaining transaction records in a digital ledger that is publicly distributed across numerous nodes. Transactions are recorded and added to the ongoing chain as 'blocks'. A key component of blockchain is smart contracts, which are self-executing agreements stored on the blockchain (International Business Machines Corporation, 2024). These contracts play a crucial role by automatically enforcing terms once predefined conditions are met, eliminating the need for intermediaries and streamlining transactions.

The functionality of blockchain is further enhanced by its key features. Data immutability ensures that once recorded, data cannot be altered, thus providing a reliable history of transactions. Significant benefit is also derived from transparency, as all participants can access the ledger of transactions that are verifiable and traceable. Given these strengths, blockchain offers a compelling solution for charity donation platforms, effectively addressing critical issues of transparency and trust in fund management. The decentralized characteristic of blockchain makes it a promising solution for managing charity donations in a more transparent and effective way, as demonstrated by research from the Charities Aid Foundation (CAF) (R. Davies, 2018).

2.2 Digital signature

Digital signatures are defined by their utilization of cryptographic techniques and asymmetric cryptography to sign data, thereby ensuring origin authentication, data integrity, and preventing signers from denying their involvement (Lin, W., 2023).

Through origin authentication, confirmation is if transactions originate from authorized individuals, thus preventing the unauthorized usage of funds. In addition, the non-repudiation feature ensures that signers cannot deny their involvement in a transaction, which holds charity representatives accountable for their actions in the event of discrepancies. These characteristics makes digital signatures are considered an effective solution for enhancing accountability within charitable organizations.

2.3 Existing studies and solutions

Growing interest in how blockchain technology can improve the donation process is indicated by recent studies on blockchain-based donation tracking systems. Significant improvements in transparency, security, and efficiency within the donation process through the implementation of blockchain systems were found by Lee et al. (2018). Additionally, a study has suggested that blockchain can address trust and accountability issues commonly faced by charitable organizations (Christie, 2020).

Comprehensive frameworks for blockchain-based donation tracking systems have also been proposed in several studies. Table 1 presents three systems proposed by different papers, outlining the stakeholders involved and the features that enable transparency and accountability within their proposed 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

Table 1 Proposed blockchain-based donation systems

Nairi et al. (2024) proposed a workflow that demonstrates the donation tracking system of their platform which combines transparency, traceability, and an escrow mechanism, as shown in Figure 2.

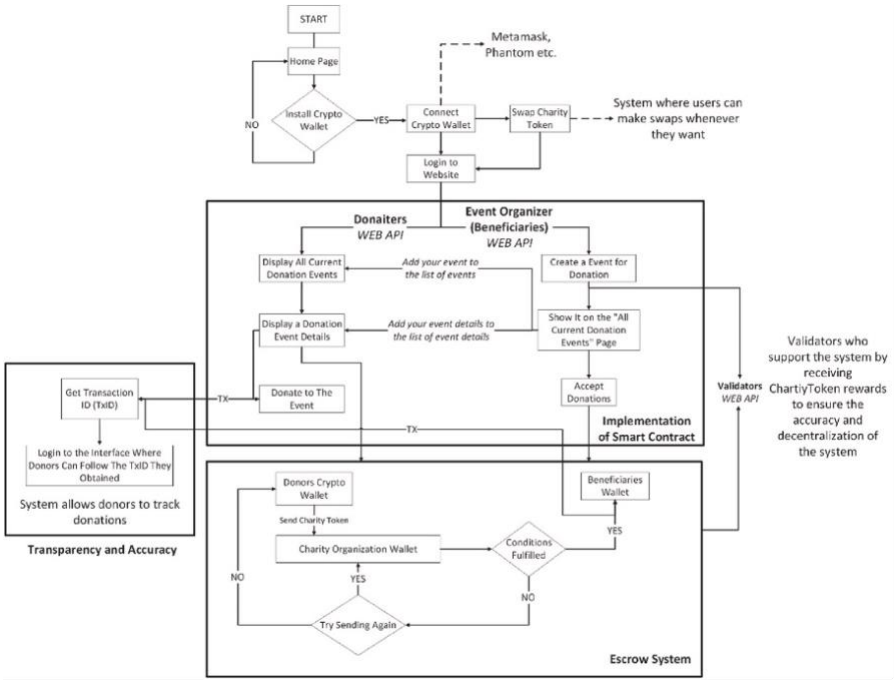


Figure 2 Donation tracking system workflow diagram (Nairi et al., 2024)

For each donation, a unique transaction identity is assigned to enable fund tracking. Through the recording of transaction details on the blockchain, real-time updates and transparency are ensured by the system. Furthermore, donations are safeguarded through an escrow system, with funds released only upon the beneficiaries meeting predefined conditions (Nairi et al., 2024).

A framework leveraging smart contracts to prevent misuse of funds has also been proposed by Farooq et al. (2020). As illustrated in Figure 3, donations are locked by smart contracts until authorized parties grant approval, at which point the payment is unlocked.

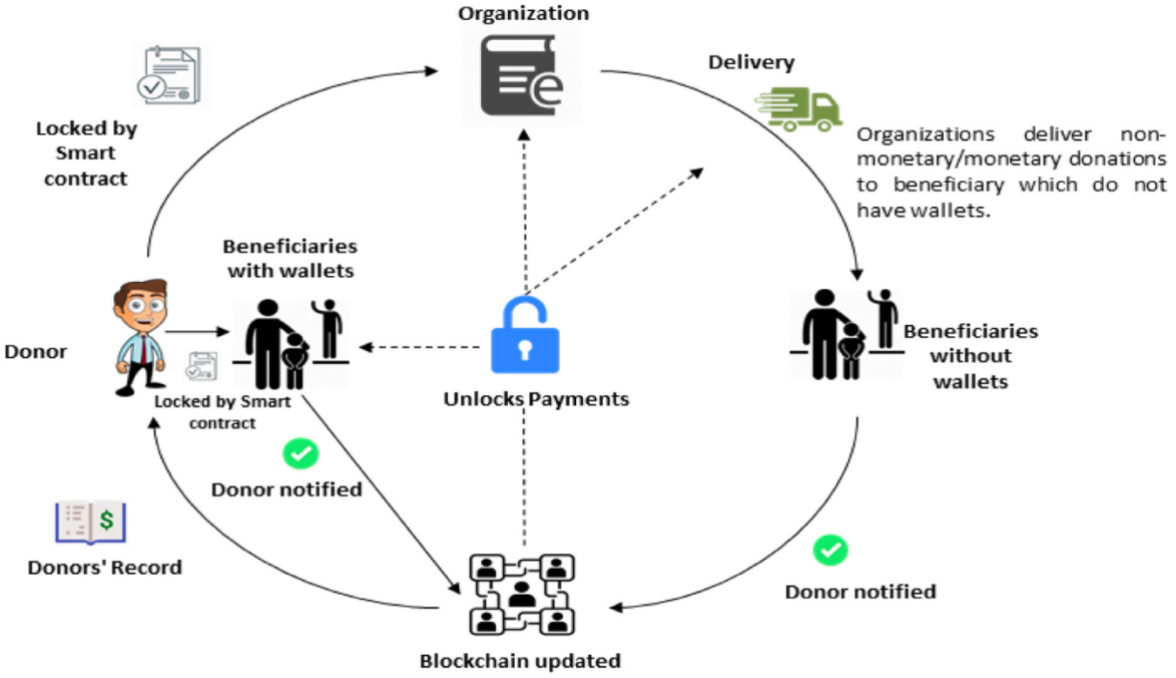


Figure 3 Proposed framework (Farooq et al., 2020)

The potential of blockchain technology to transform donation tracking and management within the non-profit sector has been demonstrated by previous research, thereby providing a robust foundation for this project.

In examining real-world applications, several blockchain donation systems are currently available. For example, Binance Charity employs smart contracts to ensure that donations are allocated for their intended purposes, and donors are provided with real-time updates regarding the impact of their contributions (Nairi et al., 2024). Additionally, GiveTrack is an example of how blockchain technology is utilized to provide real-time tracking of funds (BitGive Foundation, 2022).

Although some international charities have begun to accept cryptocurrencies as a donation method, large local charities in Hong Kong, such as the Community Chest of Hong Kong, do not accept cryptocurrencies, and platforms for donors to track their donations are unavailable. Limited research has specifically focused on blockchain solutions for donations within the Hong Kong context. Therefore, this research aims to integrate previous findings with local insights, with a concentration 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 primary components are required: the system framework, which encompasses user-related functions and journey, and the blockchain system workflow and architecture; and the user interface design of the payment system.

An initial high-level overview of the project workflow is illustrated in Figure 4. This workflow is divided into three user parties: Donors, Beneficiaries, and Trustees. Within the blockchain system, a Trustee refers to an organization possessing the list of Beneficiaries. The charity donation chain begins with the donor and concludes with the beneficiary party, with further elaboration to follow.

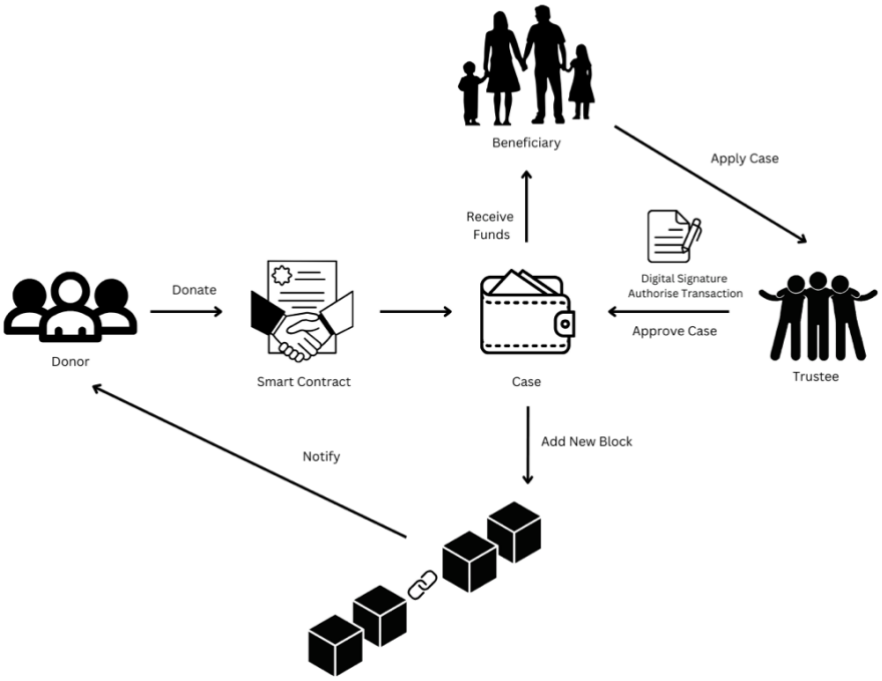


Figure 4 High-level overview of project workflow

This workflow is constructed on a public-permissioned blockchain, where only verified participants are permitted to join the network, thereby ensuring the authenticity of user identities (Almaghrabi & Alhogail, 2022). Within the blockchain network, each user is an account holder with a cryptocurrency wallet and is uniquely identified through their account address. To prevent fraud, validation of information is required for any participant seeking to join the network.

The charity donation chain begins with the donor, who donates through a smart contract. Predefined conditions, as agreed upon by the donor, are stored and executed by this contract, with no central authority or third party involved in the execution (Ølnes, S et al., 2017), thereby providing a trust layer to the donor. The beneficiary applies to the trustee through the system; if the beneficiary's conditions meet the smart contract's requirements, the trustee approves the application with a digital signature to ensure organizational accountability. Records of fund transfers are stored on the blockchain, enabling donors to verify the utilization of their donations by specific charities (Trustee) or projects (Case). Furthermore, only designated individuals are authorized to approve fund transfers, which reduces the risk of unauthorized transactions. The system facilitates real-time traceability, which allows donors to track their contributions throughout all stages of the donation process.

Donors are able to donate, track their contributions, and access information regarding transaction histories and accountability. Trustees are provided with the ability to trace donations, create cases, approve or reject requests from the needy, and withdraw funds. Meanwhile, the beneficiary is able to create cases and request withdrawals, which are subject to trustee approval. This comprehensive design ensures both transparency and accountability within the donation process.

3.2 Performance evaluation

The performance analysis will include an evaluation of the blockchain system's impact on transparency, accountability, and trust within the charity sector. Questionnaires focused on their experiences and perceptions of the system will be distributed to gather insights from donors and relevant stakeholders, specifically targeting users in Hong Kong. Through this evaluation, feedback will be gathered from a diverse range of end users, and areas within the system that require tuning, especially regarding usability and functionality, will be identified. Furthermore, comparisons with other donation systems will be conducted to assess relative effectiveness. It

is anticipated that the incorporation of valuable insights into system enhancement will help ensure that the system meets the needs and satisfies the expectations of its target audience.

4. Results and Discussion

This chapter outlines the results and findings 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 System Framework

4.1.1 Users' roles

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

Donor	Charity	Beneficiary
Browse charities and projects	Set up donation projects	Create Account
Connect crypto wallet to donate	Approve beneficiary applications	Validate identify by uploading personal information
Donate using smart contract template provided	Issue Smart Contract templates for donation projects	Apply for program eligibility (approved by Charity)
Track donations	Track projects and monitor donations	Check status

Table 2 User functions in system

4.1.2 Front-end workflow

A front-end flowchart of the system is presented in Figure 5. 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.

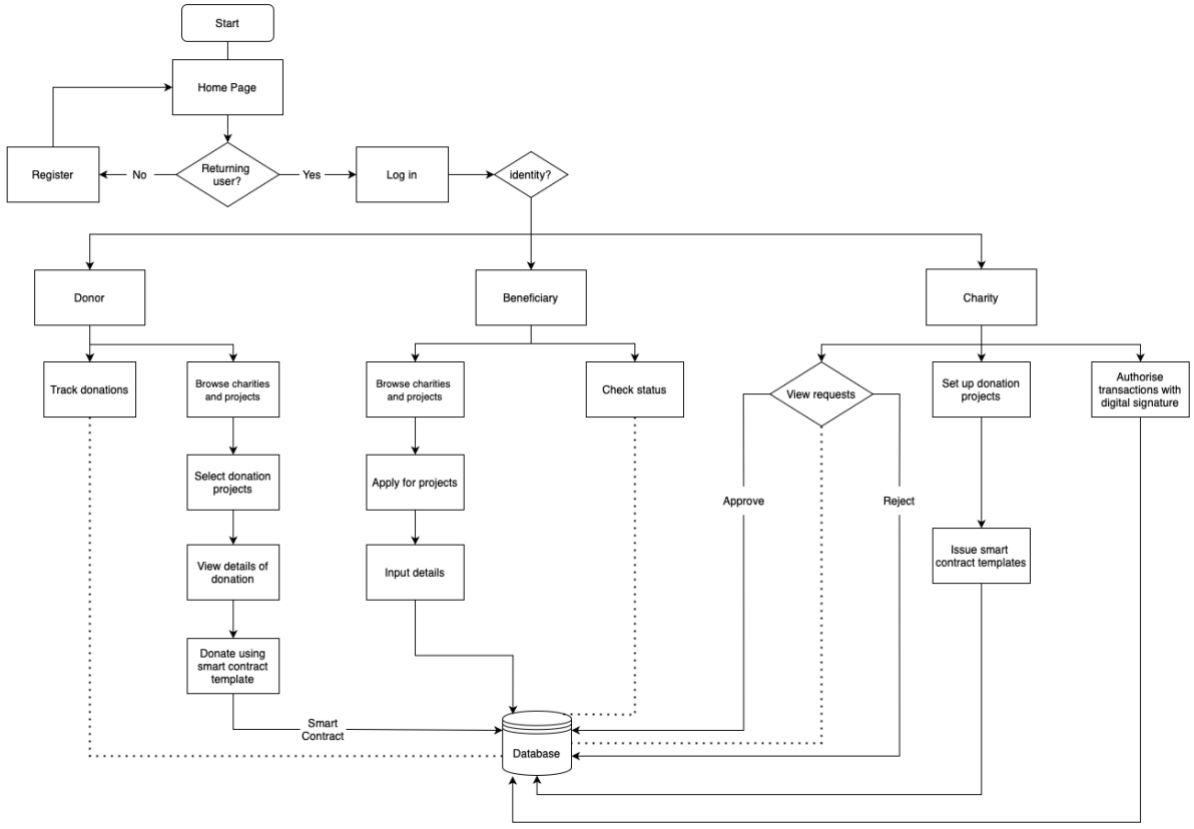


Figure 5 Front-end flowchart of system

Following successful login, donors can navigate through available charity cases and view detailed information. Upon choosing to contribute, donors will connect to their wallet and donate using the smart contract template provided by the charity. Functioning as an immutable ledger, this contract records key details such as the donor's account information and the donation amount. The smart contract is then stored in the case database, enabling donors to track their contributions by accessing the relevant records.

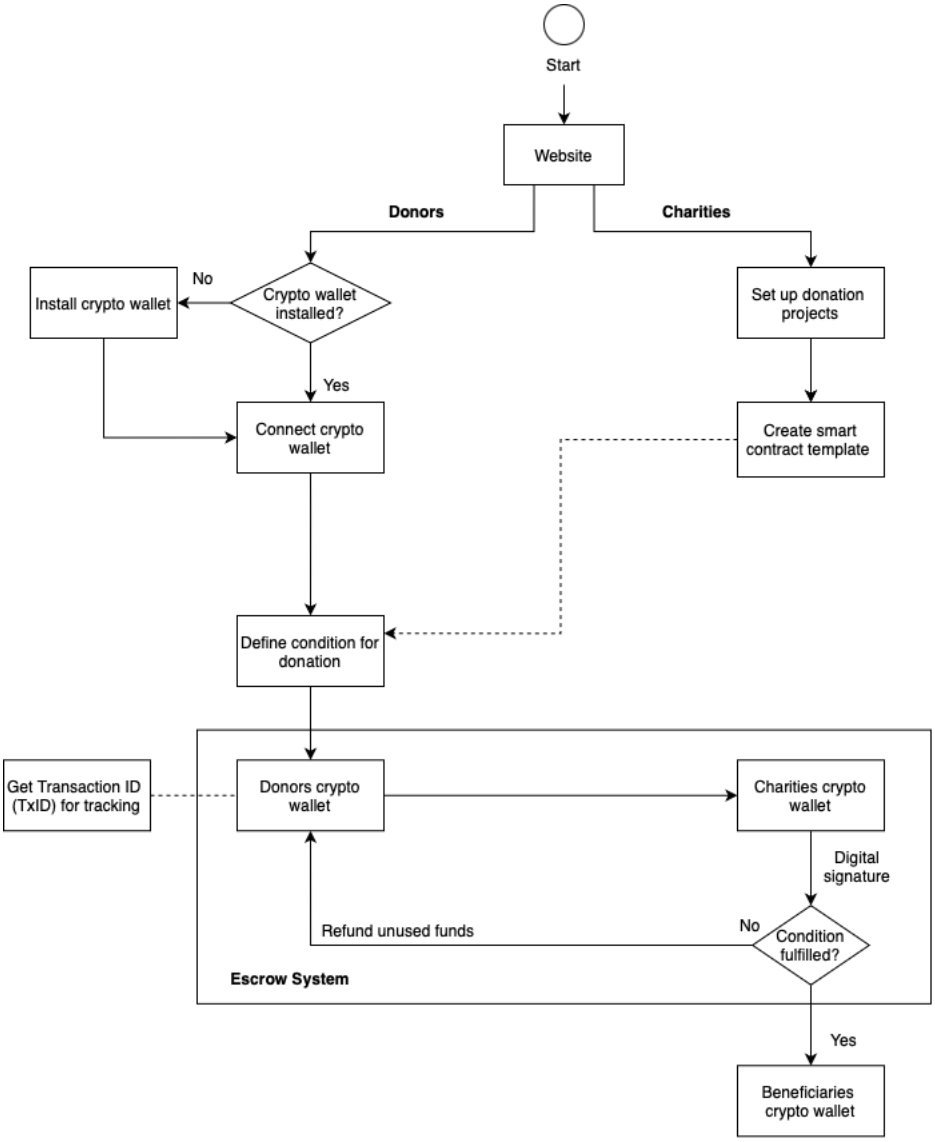
Beneficiaries can apply to opt into a program when they meet the criteria of an existing program, subject to the charity's approval. To verify eligibility, they must provide various sets of information, including address, income, and age. This data is securely stored in the case database, allowing beneficiaries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

Following an evaluation of the documents, requests submitted by beneficiaries will either be approved or rejected by the charity. Subsequently, their decisions are recorded in the database, and notifications are sent to inform applicants of the outcomes. The charity is also responsible for setting up donation programs and smart contract templates, in addition to consistently monitoring donations. A digital signature will be appended by the charity for authorizing transactions to ensure accountability.

4.1.3 Back-end donation flow

The back-end donation flow designed, illustrating the donation process through the proposed system, is shown in Figure 6. This flow involves two paths: one for donors and one for charities.

For charities, the creation of a smart contract template for a specific project is required when setting up the donation project. Fields such as the donation amount, conditions set for the



donation, donor address, recipient address, and transaction deadline may be included in this template.

Figure 6 Back-end donation flow of system

As for donors, they will first be prompted to check for the installation of a crypto wallet after selecting the donation program. Upon connecting to their crypto wallet, they can utilize the smart contract template provided by the charities to define the conditions for donation. After 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.

Within the escrow system, charities must authenticate with a digital signature through the system when transferring funds. The system will then verify whether the defined conditions have been fulfilled. If the conditions are met, 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. Through this process, assurance is if funds are directed precisely to the donors' intended recipients.

4.1.4 Digital signature

Within the proposed blockchain system, digital signatures rely on public-key cryptography, which involves a pair of mathematically linked keys: a private key that is kept secure by the owner, and a public key that is available to anyone in the network (Nervos Network., 2025). The private key is used to generate the digital signature, while the corresponding public key is used for verification. Due to this mechanism, only the legitimate owner is able to create a valid signature for a specific transaction. Meanwhile, anyone with access to the public key can confirm the authenticity of that signature without needing to know the private key.

The Elliptic Curve Digital Signature Algorithm (ECDSA), which the Ethereum blockchain the proposed system is built on uses, employs elliptic curve cryptography and offers strong security with shorter key lengths. Because of this, deriving the private key from the public key is extremely difficult, thereby ensuring that forging a signature without the correct private key is impossible (Nervos Network., 2025).

Within the system, a charity will first run the transaction details through Keccak-256, the cryptographic hash algorithm used by Ethereum (Liu, J., 2023), when a charity wants to approve a transaction involving a transfer of funds to beneficiaries. Through this process, a

unique digital fingerprint of the original data will be generated, and any minor change in transaction details will result in a completely different fingerprint, thereby ensuring authenticity and integrity. The charity is then able to use its private key to sign this hash, and a digital signature will be attached to the transaction data. If the signature is valid, the transaction is authenticated and added to the blockchain.

To verify the authenticity of the digital signature, any participant in the blockchain is able to apply the charity's public key to the digital signature and recompute the transaction's hash. Proof that the transaction was indeed signed using the charity's private key, confirming their authorization, and confirmation that the transaction data remains unchanged are provided if the computed hash matches the one attached to the transaction.

In the event of fund misuse, the person who authorized the transactions will be held accountable, as all participants in the blockchain will be able to see who authorized the transactions.

The digital signature mechanism enhances transparency and trust in the donation process by ensuring that only authorized users can approve transactions and by providing accountability.

4.2 User Interface for donors

Based on the system architecture and functions defined previously, the user interface for donors is intended to facilitate user interactions with the donation system.

4.2.1 Home page

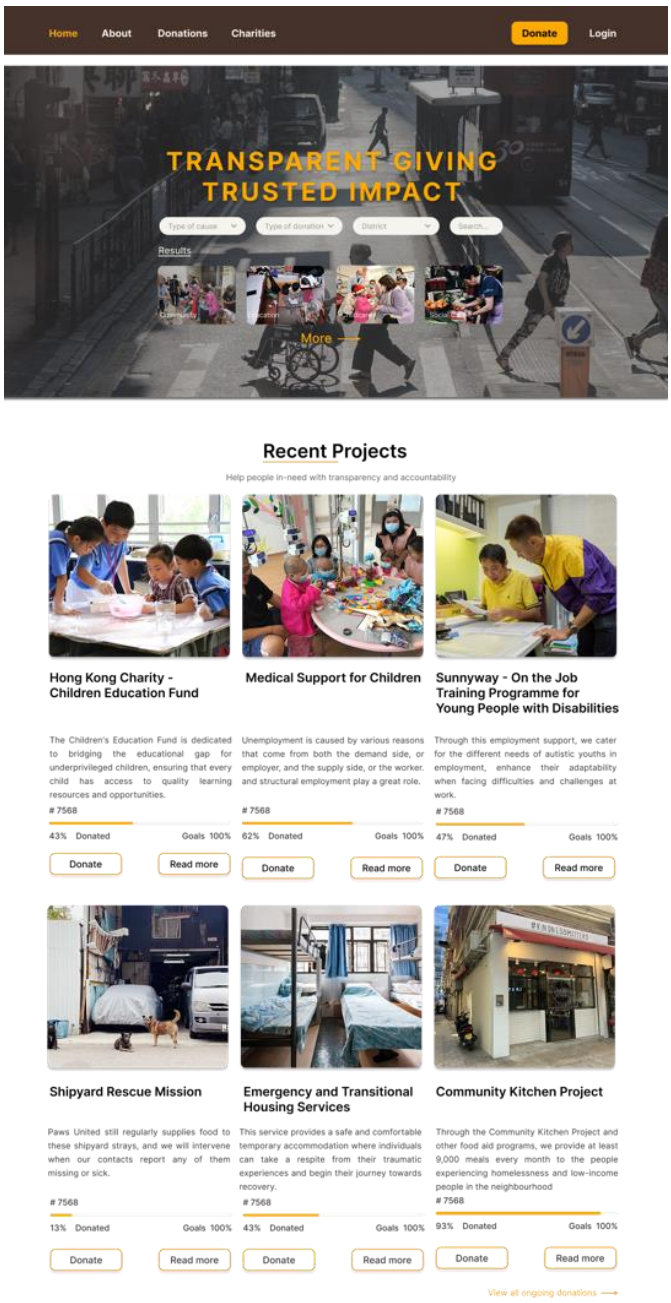


Figure 7 Home page of website

The home page in Figure 7 features a header that provides navigation to key pages, including "About" for background information, "Donations" to view ongoing donation opportunities, "Charities" to showcase all participating charities, and a "Log In" button.

Upon arriving at the home page, users are able to have a quick glimpse of recent projects and their donation progress. For users who would like to discover other donation programs, the

ability to search and filter according to different types of donation, for example Education, Childcare, or Social Care, is provided on the home page.

4.2.2 About Page

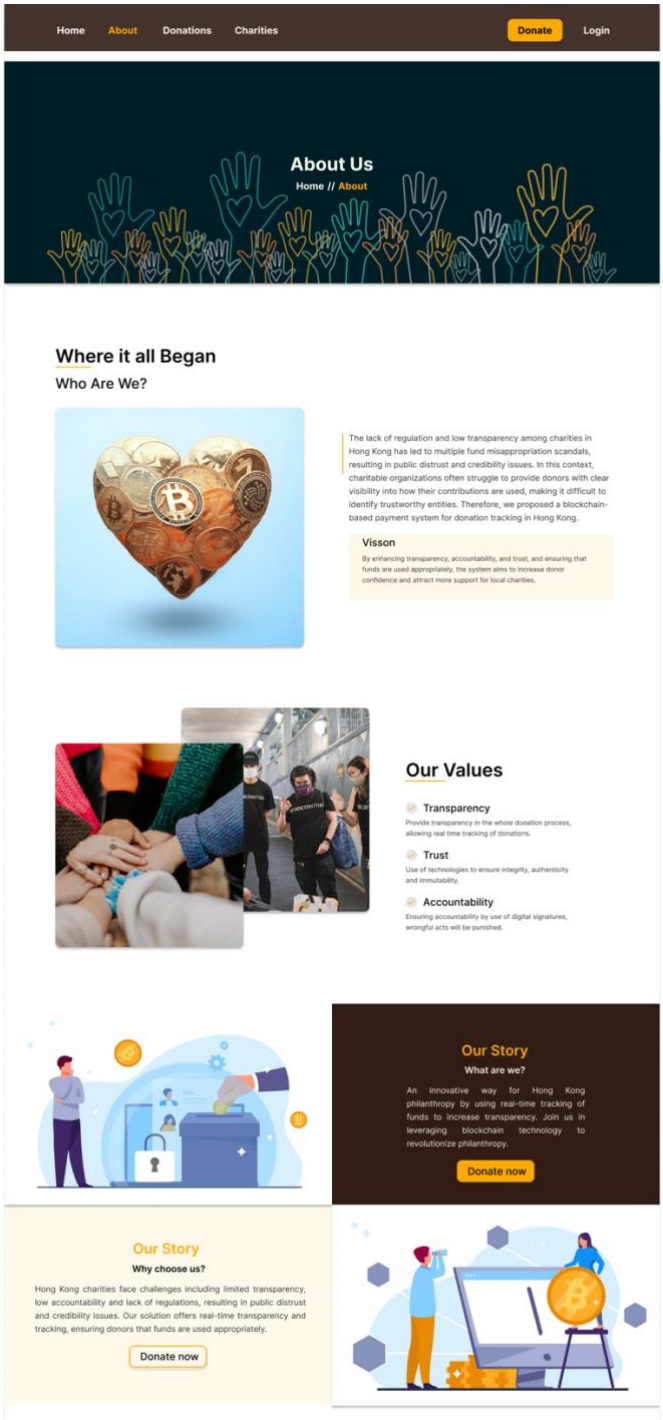


Figure 8 About page of website

A dedicated ‘About’ page shown in Figure 8 has been designed to provide visitors with a clear understanding of the project’s background, mission, and values. This page includes an introduction of this project imitative, highlighting the motivation to address transparency and trust issues in Hong Kong charities through adopting blockchain technology.

4.2.3 Donation Details Page

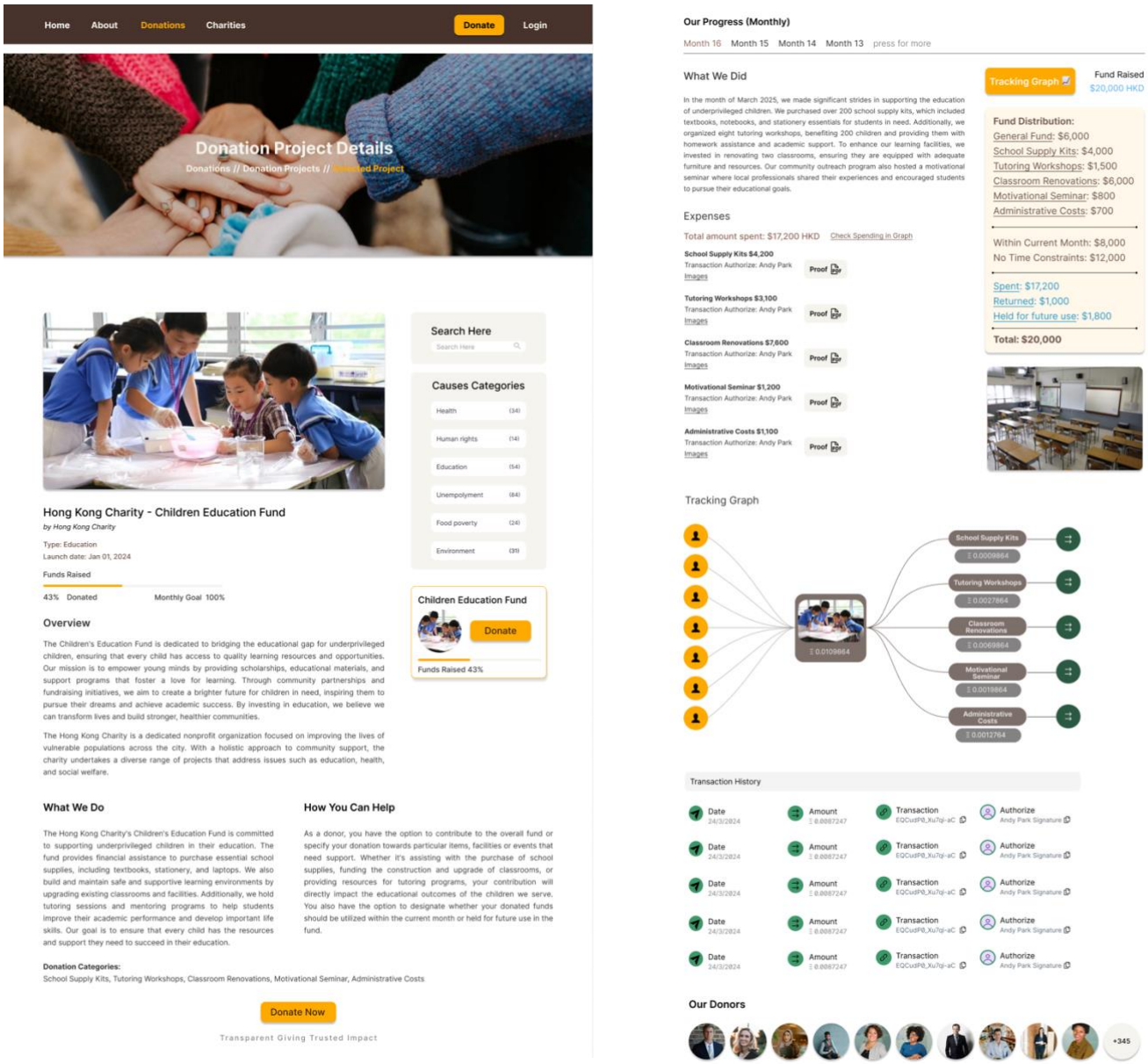


Figure 9 Donation Page and Donation Process Tracking of Website

When donors wish to learn more about the donation project, they are redirected to the donation page where detailed information about the project is presented in Figure 9 (left). On this details page, an overview of the organisation is provided, enabling donors to understand how their contributions will be utilized to support the organisation. A progress chart is displayed at the top of the page to allow donors to easily monitor the progress of the donation project.

Beneath the project details, monthly progress updates are provided in Figure 9 (right). Each month, the charity updates the page to report activities undertaken, such as the purchase of new supply kits and Tutoring Workshops. Every expense incurred is listed along with the corresponding invoice attached to ensure transparency for donors. The authorizer of each transaction is also displayed to guarantee accountability. For donors wishing to verify blockchain transactions, a tracking graph is made available, recording all transaction history for the respective month. By clicking on a transaction arrow within the graph, donors are redirected to a transaction detail page where comprehensive information about the transaction is presented in Figure 11.

4.2.4 Donation Payment Page

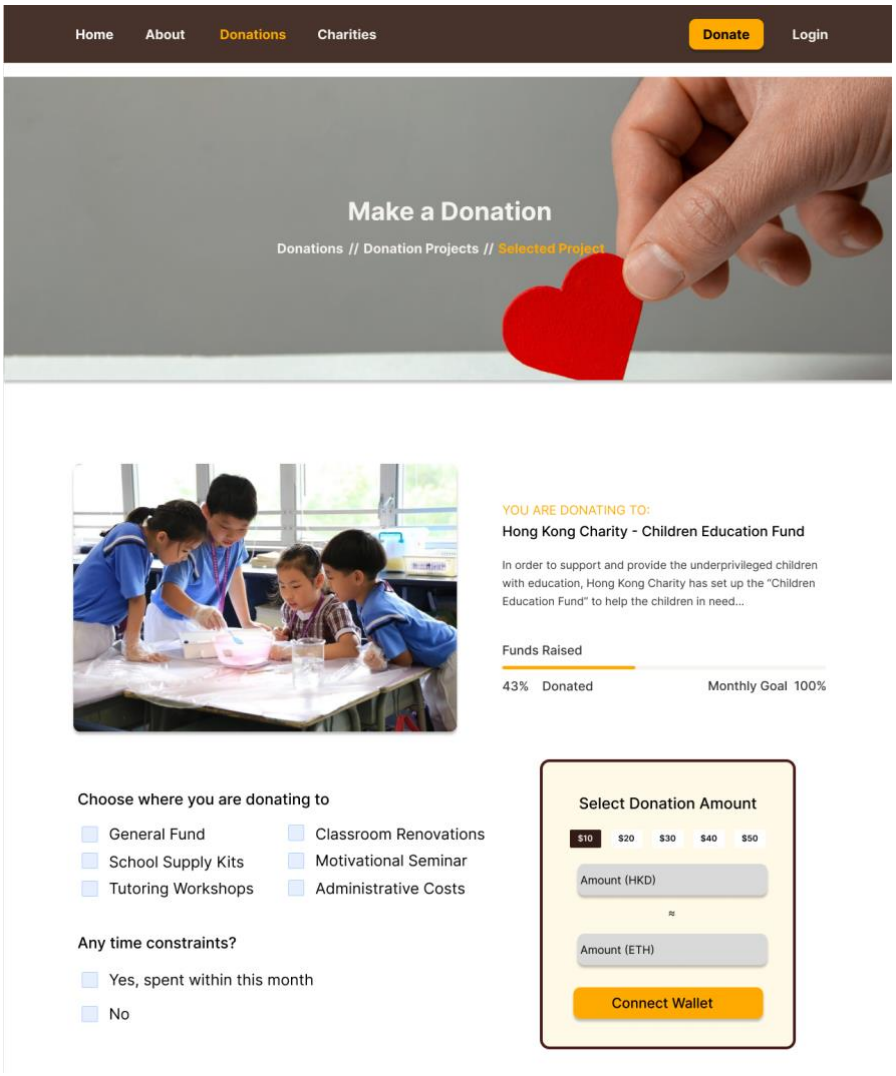


Figure 10 Donation payment page of website

Once the 'Donate' button is clicked by donors, they are directed to the donation payment page. On this page, donors are provided with the option to select the specific streams to which their funds will be allocated, allowing for greater customization. For example, donations can be restricted to Tutoring Workshops and Motivational Seminars only. Additionally, donors are given the option to specify that their contributions be utilized within the current month, thereby enabling greater control over the fund disbursement. After the donation preferences have been finalized, donors are prompted to enter the amount they wish to contribute in Hong Kong Dollars. This amount is then converted into an equivalent value in Ethereum. Upon

confirmation of the donation amount, donors are required to connect their digital wallets to complete the transaction.

4.2.5 View My Donation Page

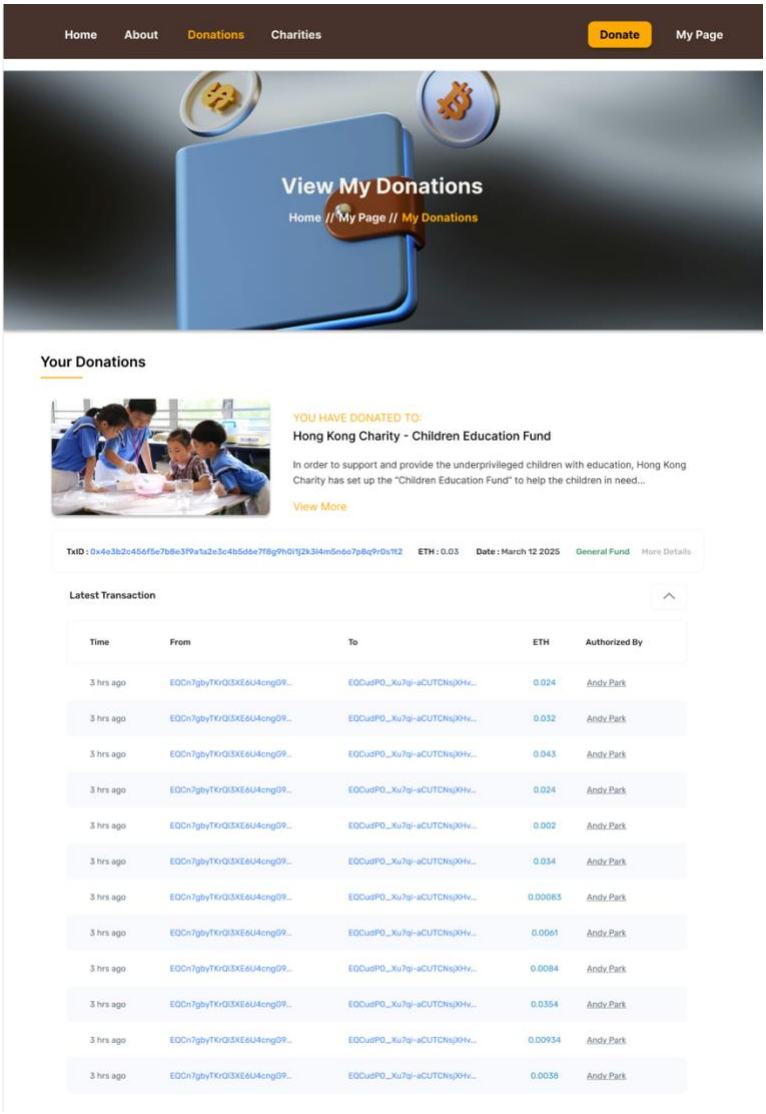


Figure 11 View My Donation Page

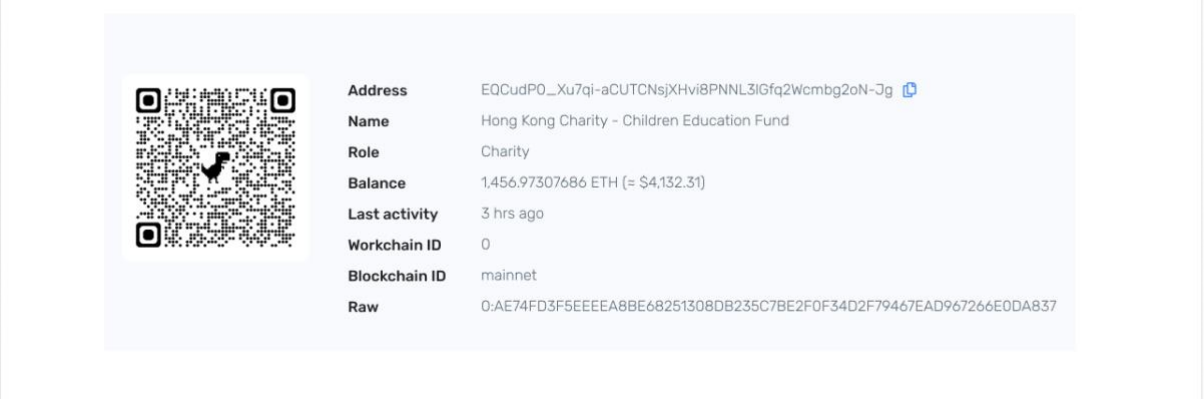


Figure 12 Address Details

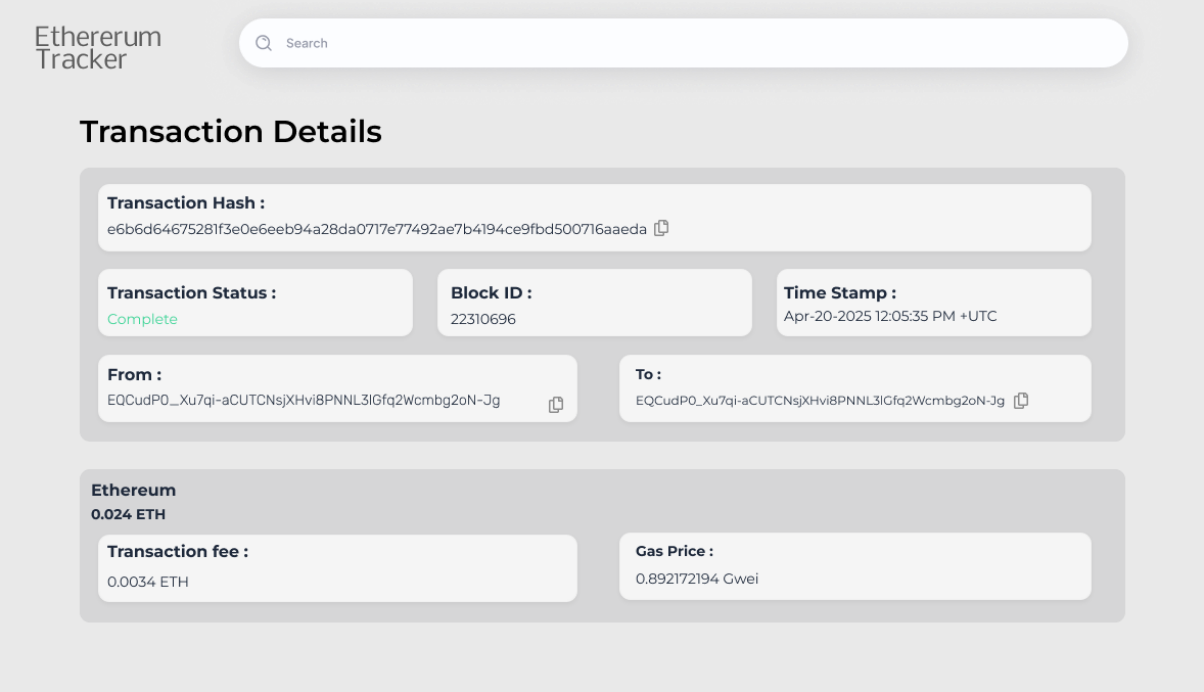


Figure 13 Ethereum tracker page

Donors are able to trace their own donations on the 'My Donation' page, where detailed information regarding their contributions is listed. Transaction IDs (TxID), Ethereum amounts, dates, and types of donations are all made available for retrieval shown in Figure 11.

The latest transaction history of the project is also displayed below this section. When donors click on an address, detailed information about that address is shown in Figure 12. The name and role of the recipient associated with the address are provided, thereby ensuring transparency among all participants.

If donors wish to examine the details of a particular transaction, clicking on the Ethereum amount within each transaction redirects them to an Ethereum Tracker page shown as Figure 13. On this page, all relevant details of the transaction can be accessed. The upper section contains block information, including the transaction hash, block ID, and timestamp. Donors are also able to copy the address for further reference within the Ethereum Tracker. The lower section presents transaction-specific information, such as the transaction amount, transaction fee, and gas price involved.

4.3 Questionnaire Feedback

Our group conducted an online survey to collect feedback regarding the design and performance of our system. A total of 127 responses were received, with participants' ages ranging from 20 to 64 years. The survey was divided into two main sections: the first focused on respondents' perceptions of blockchain technology and local charities, while the second sought their feedback on the project's demonstration.

Regarding their views on local charities, majority of respondents expressed concerns about the transparency and use of donated funds. Notably, over 87% of participants indicated that they have refrained from donating to charities due to doubts about usage of fund and transparency. This finding underscores the critical importance of transparency in fund usage when making donation decisions and validates the problem our project aims to address.

When asked about potential improvements for local charities, a significant proportion of respondents advocated for enhanced financial reporting and more effective communication with donors. Furthermore, when queried about whether a traceable record of fund movement would increase their confidence in donating, 67% responded affirmatively, while an additional 29.92% answered "maybe." These results highlight that traceability is a key factor in fostering donor confidence.

To evaluate the performance of our system, the survey also incorporated questions regarding user feedback. A significant majority of respondents (81.1%) agreed that the system clearly demonstrated how donations are tracked and utilized. Furthermore, over 88% of participants concurred that the system could enhance transparency in Hong Kong charity donations. Specifically, 77% and 72% of respondents agreed that the system would improve their trust in Hong Kong charities and their use of funds, respectively. Additionally, 79.53% of participants indicated that the system encourages them to donate more to Hong Kong charities, and 65.35% expressed support for using a blockchain-based donation system for future contributions after viewing the project demonstration. These findings reinforce the fundamental objective of this project — transparency and trust.

However, respondents also expressed concerns regarding blockchain technology. In terms of familiarity, 78% of participants reported that they were not familiar with blockchain, and only 17.32% owned cryptocurrency. This suggests that a lack of knowledge and the relatively low popularity of blockchain may pose obstacles to donor participation. Nevertheless, when asked

whether they believed that blockchain could enhance the transparency of charity donations, 86.61% responded affirmatively.

4.4 Benchmarking

To evaluate the relative effectiveness of the proposed donation system in enhancing transparency and accountability in Hong Kong charities, a benchmarking analysis will be performed through a comparison with existing solutions in the market, specifically Binance Charity and Givetrack, as well as online platforms of Hong Kong charities.

Binance Charity (Binance Charity, n.d.) and Givetrack (GiveTrack, n.d.) are both global donation platforms built on blockchain technology, offering references for comparing features related to transparency, traceability, and accountability. On the other hand, online donation platforms of Hong Kong charities, such as the Community Chest (The Community Chest of Hong Kong, n.d.) and Po Leung Kuk (Po Leung Kuk, n.d.), provide references for evaluating the proposed system within the specific context of charitable giving in Hong Kong.

As presented in Table 3, the proposed system is compared with existing solutions across various features. With the proposed system, alongside Binance Charity and Givetrack, real-time tracking of donations through blockchain technology is enabled, a feature that Hong Kong charities currently lack. On their front-end webpages, both the proposed system and Givetrack clearly display fund movements, thus allowing donors to see exactly how the donations are used, such as the exact amount of donations used in buying equipment, along with the transaction date and proof. Included as unique features by the proposed system are digital signatures, personal tracking graphs, and an escrow system, which further enhance transparency, traceability, and accountability in the donation process.

Features	Binance Charity	Givetrack	Proposed system	Hong Kong charities' online platforms
Real-time tracking of donations	Yes	Yes	Yes	No
Clear display of fund movements	No	Yes	Yes	No
Digital signature	No	No	Yes	No
Personal tracking graph	No	No	Yes	No
Escrow system	No	No	Yes	No

Targeted donation	No	No	Yes	No
Charity-based	No	No	Yes	Yes
Hong Kong charities and projects	No	No	Yes	Yes

Table 3 Comparison of features in different donation systems

In terms of donation options, donors are allowed by the proposed donation system to make targeted donations, specifying precisely where their donations should be used, thus providing a higher level of personalization compared to the other donation systems. Designed for Hong Kong charities, the proposed system is charity-based and features local charities and projects, unlike Binance Charity and Givetrack.

Through this benchmarking analysis, incorporation of features from existing solutions in the market, alongside additional functionalities that enhance transparency, traceability, and accountability, are demonstrated by the proposed system. By addressing the specific needs of charitable donations in Hong Kong, the proposed system is presented as an effective solution.

4.5 System Evaluation

This section evaluates the proposed system across four key aspects: transparency, accountability, trust, and immutability, to illustrates that the system achieve the objectives proposed in Section 1.3.

4.5.1 Transparency

Blockchain technology enhances visibility and ensures that every step in the donation process is documented and verifiable (Kannengießer et al, 2020). By adopting blockchain technology in this donation system, the transparency of each fund movement has been increased. Features such as the tracking graph (Figure 8.2) and transaction Ethereum tracker (Figure 11) have been included in the system, enabling constant monitoring of fund movement by everyone within the network. Monthly progress updates (Figure 8.2) have also enhanced transparency through the listing of expenses and corresponding proof, thus avoiding charities to malpractice the fund. Survey evaluation has revealed that 88.98% of interviewees agree that this system helps to raise transparency in Hong Kong charity donations, and 65.35% are likely to participate in donating through a blockchain donation system. Through these figures, statistical support of how transparency has improved when a blockchain system is implemented has been provided.

4.5.2 Accountability

Accountability entails ensuring the responsibility of an individual or organization for their actions. Specifically, in this paper, it refers to holding charities or individuals accountable for the utilization of donations, especially in instances of fund misuse. In addition to blockchain, the proposed system incorporates digital signatures, which only allows authorized participants to approve transactions. With the Elliptic Curve Digital Signature Algorithm (ECDSA) and the cryptographic hash algorithm Keccak-256, impersonating an authorized participant and forging a signature is ensured to be nearly impossible.

The ability to view who authorized the transactions on the blockchain is provided to all participants. On the "Donation project" page (Figure 8.2) and "View My Donation" page (Figure 9), the individual who authorized the transaction is shown to donors and other parties. In the event that misuse of donations is discovered, identification of the individual who authorized the specific transaction is easily and efficiently achieved, and that individual would be held accountable. Compared to existing donation charity platforms in Hong Kong, which often lack a designated responsible person for the use of donations, a clearly identified responsible individual for each transaction is ensured by the proposed system, which also ensures accountability.

4.5.3 Immutability

A guarantee that no transaction can be altered or deleted once recorded on the blockchain, thereby achieving immutability, is ensured by the use of digital signatures and blockchain in this system. Upon authorization and approval, a transaction is recorded on the blockchain. With cryptographic hashing, each transaction is linked to its predecessor, thereby creating a secure chain of records. For this reason, any attempt to modify the transaction would require altering subsequent blocks, which is extremely difficult, and would not receive consent from the majority of network participants. Consequently, donation transactions within the proposed system would be immutable.

4.5.4 Trust

The trust among stakeholders is fostered by the nature of blockchain, transparency, and immutability. The same immutable record can be accessed by donors, charities, and beneficiaries, and the movement of funds can be independently verified in each transaction

record, including the address and recipient identity (Figure 10). According to the survey results, 71.65% and 77.17% of interviewees agree that this system strengthens their trust toward Hong Kong charities and the use of funds. By laying the foundation of trust, the transparency provided by the blockchain encourages integrity among stakeholders, particularly the accountability of authorizers, and ultimately reinforces confidence in the Hong Kong charities donation process.

4.6 Challenges

Despite the promising performance of the proposed system, several limitations and challenges have been identified during the project. These include the technology acceptance and knowledge of the Hong Kong public regarding blockchain, the adaptability of local charities to the new system, and regulatory challenges within Hong Kong. Addressing these issues is essential for enhancing the system's effectiveness and ensuring its successful integration into the local charity sector.

4.6.1 Blockchain Penetration

The first challenge pertains to the low infiltration of blockchain in Hong Kong context. Survey results indicate that 78.84% of interviewees report unfamiliarity with blockchain technology. Over 80% of respondents expressed that a lack of knowledge and the perceived complexity of blockchain are major concerns when considering donations through a blockchain system. Furthermore, only 17.32% of those surveyed indicated that they hold cryptocurrency. These findings suggest a prevailing lack of awareness regarding blockchain technology among the public. This poses an obstacle to the widespread adoption of blockchain in donation processes, potentially diminishing the project's overall effectiveness.

The effective adoption and implementation of blockchain technology relies on public awareness and understanding its benefits, it is imperative to priorities efforts to educate public and bridge the knowledge gap. Despite the general unfamiliarity with blockchain technology, a significant portion of interviewees expressed support for using blockchain for donations after a demonstration of the system. This indicates that resistance to the technology is not inherent, but rather stems from a lack of knowledge, highlighting both the potential of the system and the critical importance of blockchain education.

4.6.2 Hong Kong charity adaptability

The adaptability of local charities to the proposed blockchain-based system presents another challenge. Many charities in Hong Kong already operate their own established systems and platforms for receiving donations. A transition to this new technology would require considerable effort, resources, and commitment, which may not be feasible for all organizations. Additionally, uncertainty exists regarding the willingness of charities to adopt these changes, particularly given that some may lack the necessary knowledge about blockchain technologies, cryptocurrencies, and digital signatures. This knowledge gap could lead to skepticism about the benefits of the new system, making it difficult to convince them to participate. Furthermore, potential conflicts of interest may arise, complicating the transition and further hindering the adoption of this blockchain platform within the sector.

To address this challenge, communication with local charities is essential. Through demonstration of how the system works, and how it could enhance the credibility of charities and potentially attract more donations, charities will be more interested in participating. Additionally, understanding the specific difficulties local charities face in adapting to the proposed system is important. Through consideration of their feedback and adjustment of the system, charities would be more willing to embrace this change, which would ultimately foster a smoother transition and enhance overall effectiveness.

4.6.3 Regulatory constrains

Blockchain technology and cryptocurrency have been identified as disruptive innovations with significant potential in transforming payment systems. However, this potential is accompanied by regulatory challenges. A clear regulatory framework can foster an environment conducive to innovation while simultaneously protecting users and ensuring the integrity of the system. Yet, in Hong Kong, a comprehensive regulatory framework for the adoption of blockchain and cryptocurrency as a payment system is currently lacking. This absence of clear regulatory guidelines may present a challenge in securing user confidence, as both donors and charities may experience uncertainty regarding whether the system's setup adheres to industry standards.

Effective regulation is essential to provide a clear framework for the legal and compliance aspects of using blockchain technology, thus necessitating collaboration between the government and various stakeholders. Nonetheless, in the Chief Executive’s 2024 Policy Address, the Hong Kong SAR Government unveiled its plan for adopting blockchain technology (Policy Address, 2024) to promote the development of smart cities. This

development will likely encourage regulatory bodies to formulate regulations regarding the standards of blockchain and cryptocurrency.

4.7 Next Steps

Through prototyping and evaluation, the effectiveness of the proposed system in enhancing transparency, trust, and accountability within the Hong Kong charity sector has been proven. The focus, moving forward, will be on integrating the system into real-life applications. To achieve this, a more comprehensive user experience for all parties involved must be created. The user interface for beneficiaries and charities should be designed, and feedback from both groups should be collected to ensure that the platform meets their needs. Additionally, given that 80.31% of respondents expressed interest in a mobile application, designing the front-end interface for mobile apps and ensuring compatibility across devices will be essential. Finally, because 74.02% of respondents indicated a desire for community engagement features, blogs and discussion forums could be developed to enhance interaction on the platform.

4.8 Project Schedule

The deliverables and milestones to be achieved in different stages are detailed in the project schedule outlined in Table 4. Throughout the months, the project has been progressing on schedule, thus achieving the desired goals and results.

Following the submission of this final report, a final presentation and exhibition on the project will be held, along with a video demonstration of the system.

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

Table 4 Project Schedule

5. Conclusion

Over the years, the philanthropic landscape continues to grow and develop. However, instances of fraud and fund misallocation have resulted from the lack of regulations and oversight, thereby eroding public trust in local charitable organizations. To address this pressing issue, a blockchain-based payment system is proposed by this project, with the aim of enhancing transparency, trust, and accountability in charitable organizations. Through the provision of 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 the literature review, design of the prototype, and various evaluations of the proposed system, a comprehensive design for a blockchain-based donation system tailored for Hong Kong charities has been developed. Moving forward, challenges to be addressed include user adoption and regulatory concerns in Hong Kong. Nevertheless, the proposed system has proven to be effective in enhancing transparency, trust, and accountability in Hong Kong charities, thereby paving the way for a more credible framework for local charitable donations.

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Appendix A: Questionnaire and Results

Questionnaire on Blockchain Payment System for Hong Kong Local Charity

Hi,

We are final-year BASc(FinTech) students from The University of Hong Kong (HKU), working on our final year project focused on blockchain-based payment system for local charities. We are conducting a survey aimed at understanding public perceptions of charities in Hong Kong and gathering feedback on our proposed system.

Your contributions will be invaluable in shaping our project and ensuring its relevance to the needs of both charitable organizations and their supporters. The survey will address various topics, including trust in charitable institutions, payment preferences, and perspectives on integrating blockchain technology into charitable donations.
All data collected will be handled with the care and will be used solely for research purposes.

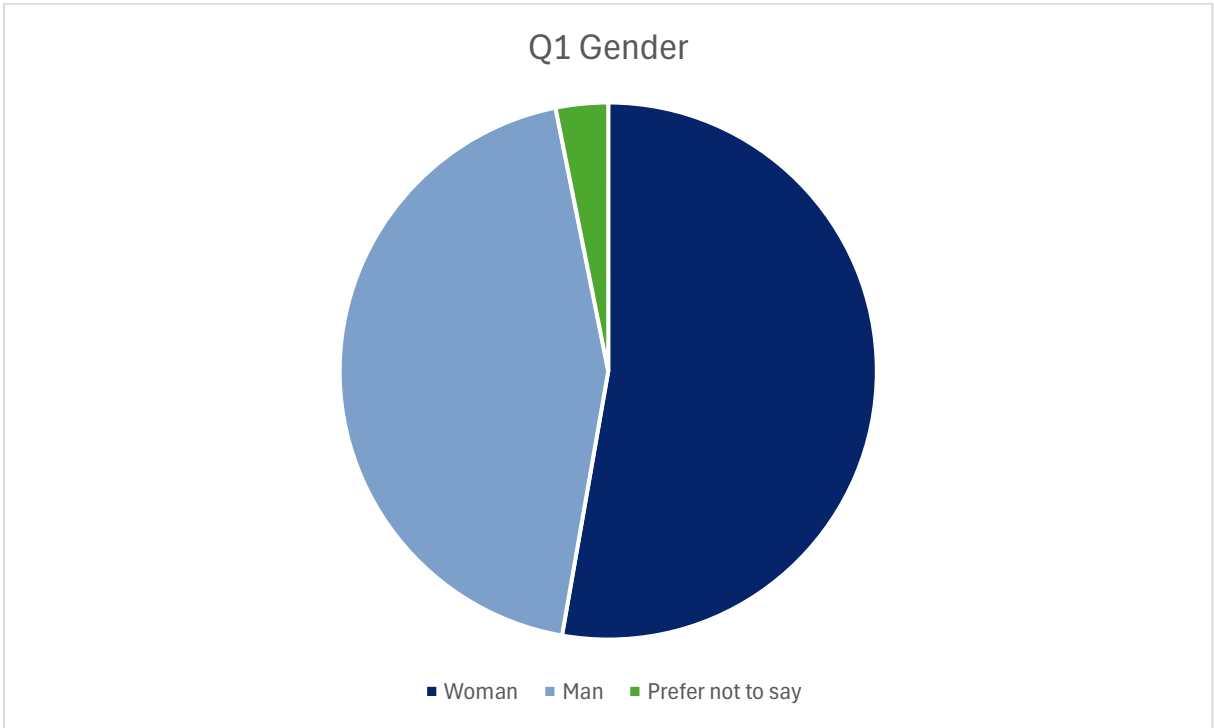
Thank you for your time and support!

Personal Details

1

Gender *

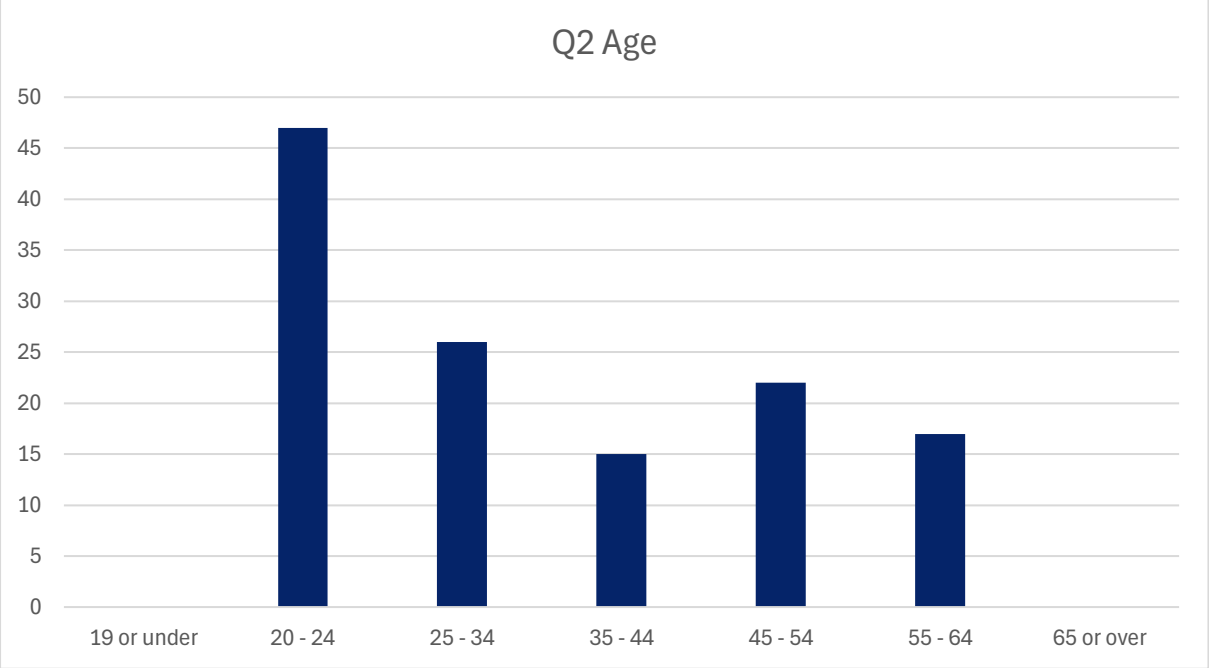
- ◯ Woman
- ◯ Man
- ◯ Prefer not to say



2

Age *

- 19 or under
- 20 - 24
- 25 - 34
- 35 - 44
- 45 - 54
- 55 - 64
- 65 or over

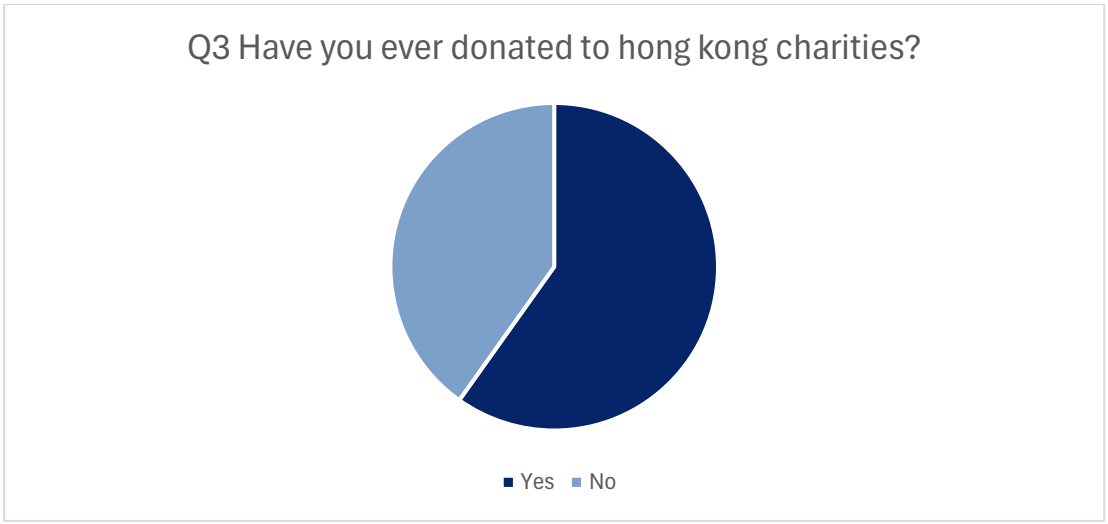


Impression towards Hong Kong Charities

3

Have you ever donated to hong kong charities? *

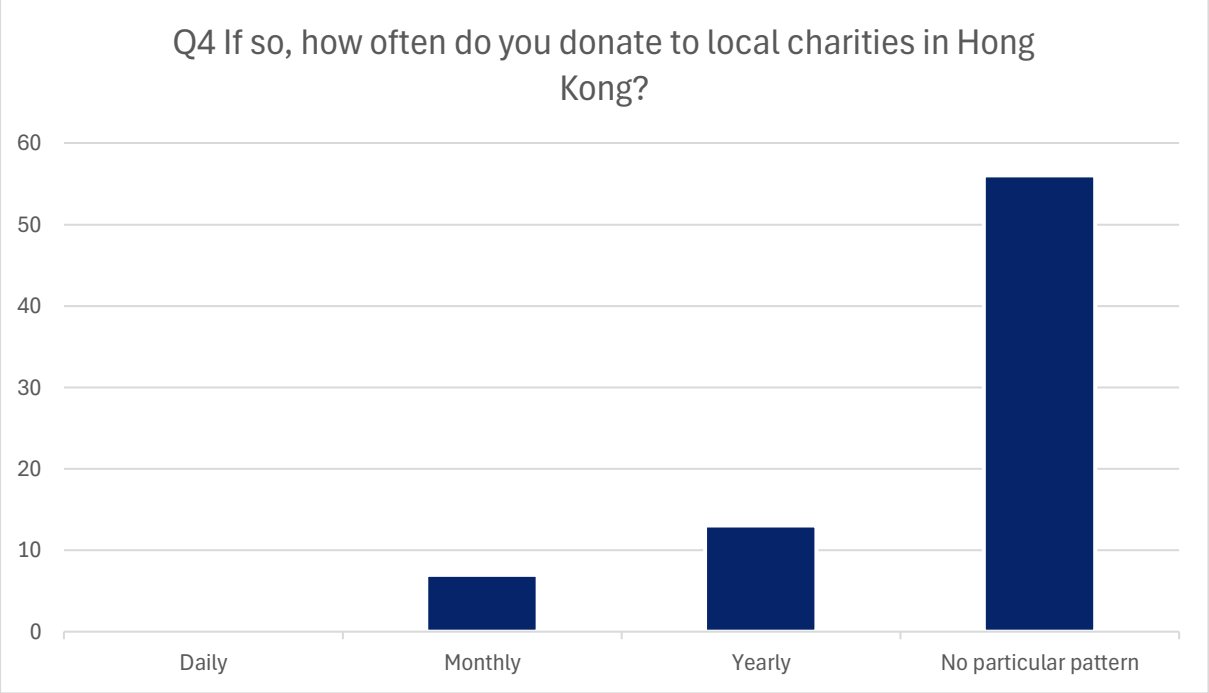
- Yes
- No



4

If so, how often do you donate to local charities in Hong Kong?

- Daily
- Monthly
- Yearly
- No particular pattern

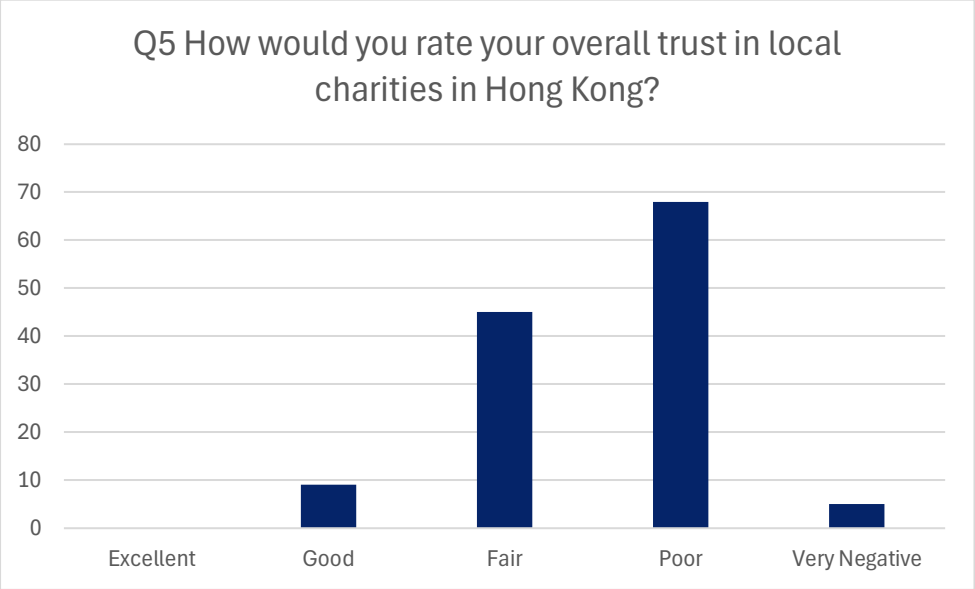


5

How would you rate your overall trust in local charities in Hong Kong?

*

- ◯ Excellent
- ◯ Good
- ◯ Fair
- ◯ Poor
- ◯ Very Negative

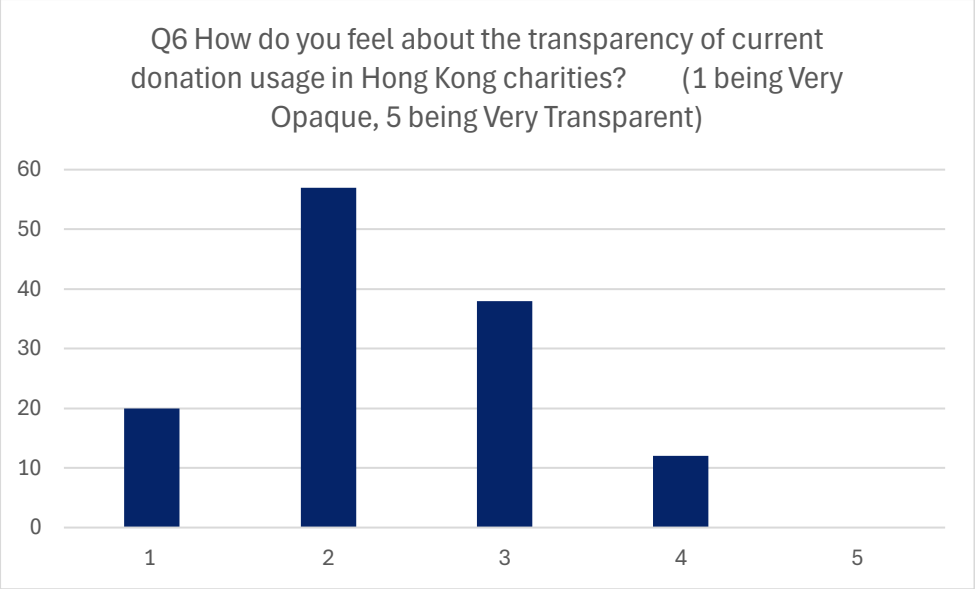


6

How do you feel about the transparency of current donation usage in Hong Kong charities? (1 being Very Opaque, 5 being Very Transparent)

*

	1 (Very Opaque)	2	3	4	5 (Very Transparent)
	◯	◯	◯	◯	◯

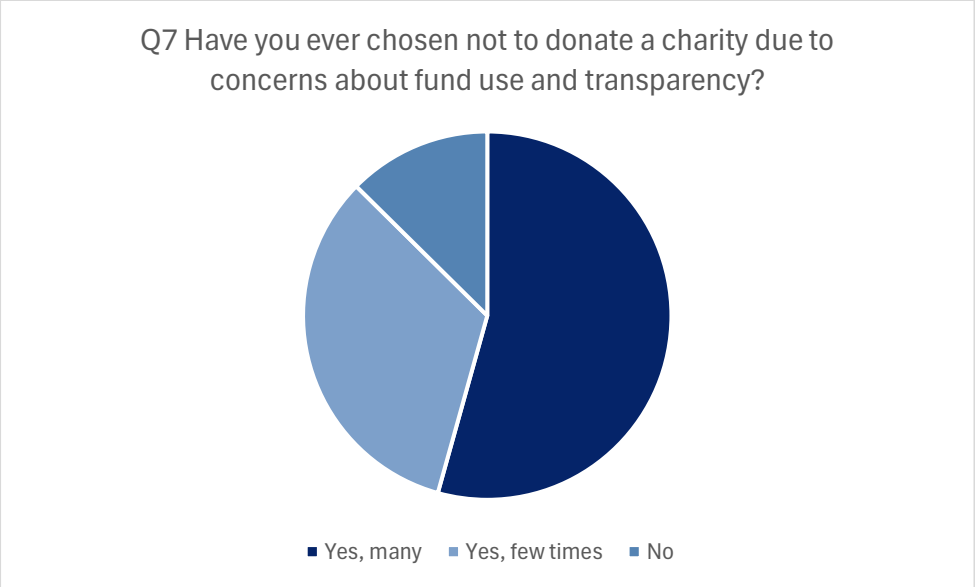


7

Have you ever chosen not to donate a charity due to concerns about fund use and transparency?

*

- Yes, many
- Yes, few times
- No

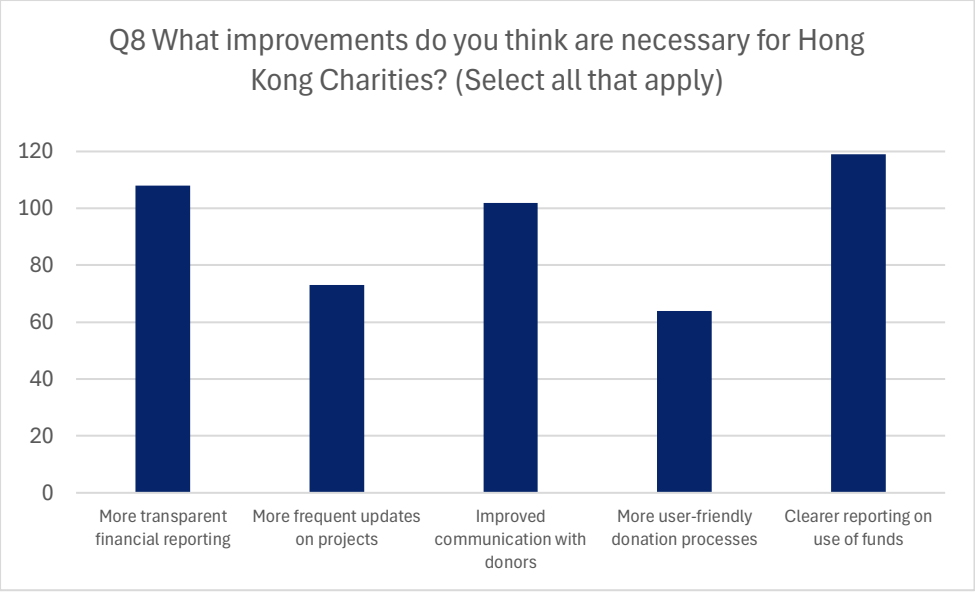


8

What improvements do you think are necessary for Hong Kong Charities? (Select all that apply)

*

- [ ] More transparent financial reporting
- [ ] More frequent updates on projects
- [ ] Improved communication with donors
- [ ] More user-friendly donation processes
- [ ] Clearer reporting on use of funds

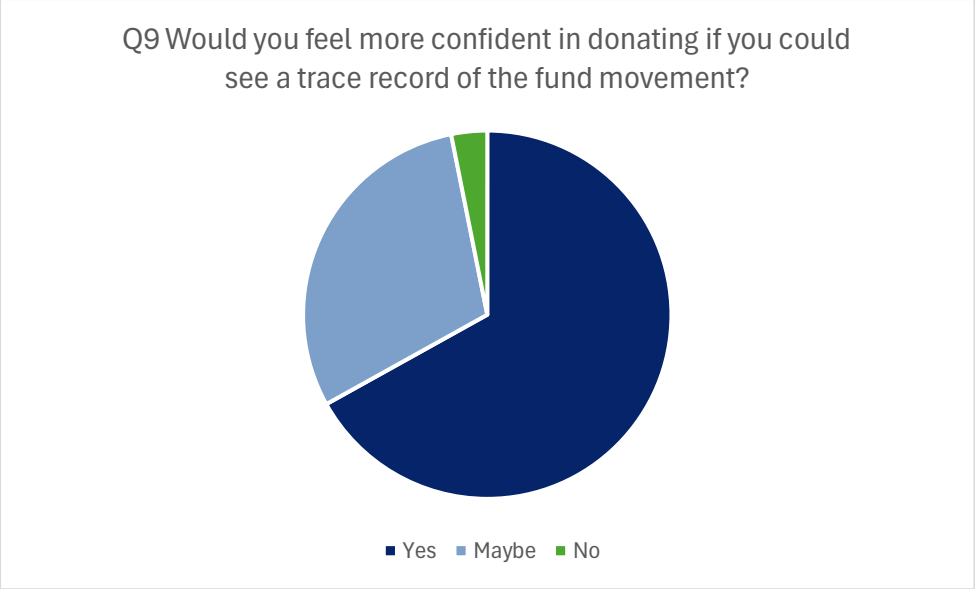


9

Would you feel more confident in donating if you could see a trace record of the fund movement?

*

- ◯ Yes
- ◯ Maybe
- ◯ No



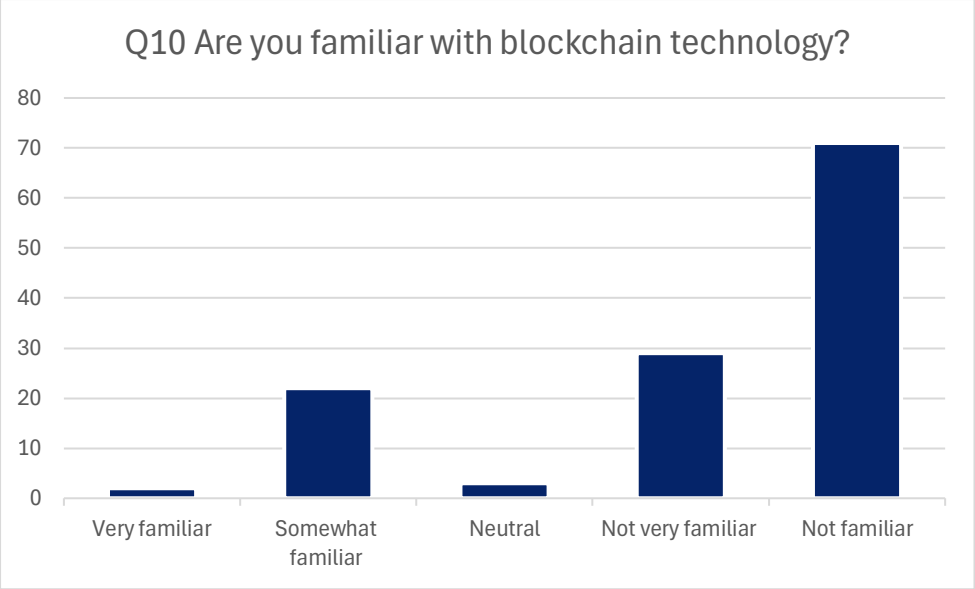
Blockchain and Cryptocurrency

Blockchain is a distributed ledger that maintains a secure and decentralized record of transactions.
Transactions are permanently recorded (immutable) and can be viewable to anyone.
Cryptocurrency, such as Bitcoin and Ethereum, is a decentralized digital currency that runs on blockchain.

10

Are you familiar with blockchain technology? *

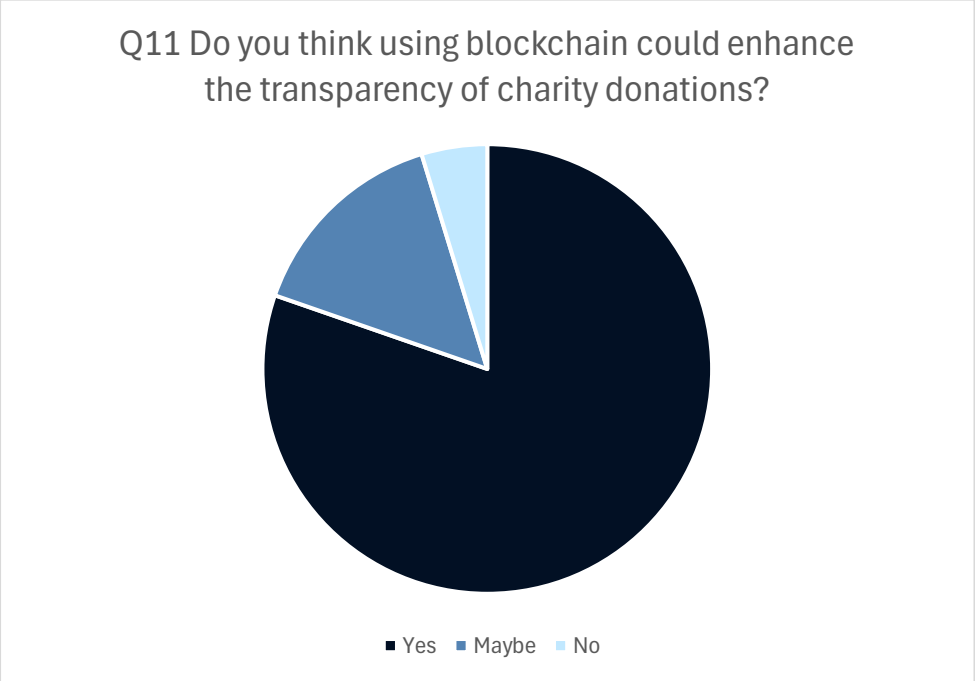
- Very familiar
- Somewhat familiar
- Neutral
- Not very familiar
- Not familiar



11

Do you think using blockchain could enhance the transparency of charity donations? *

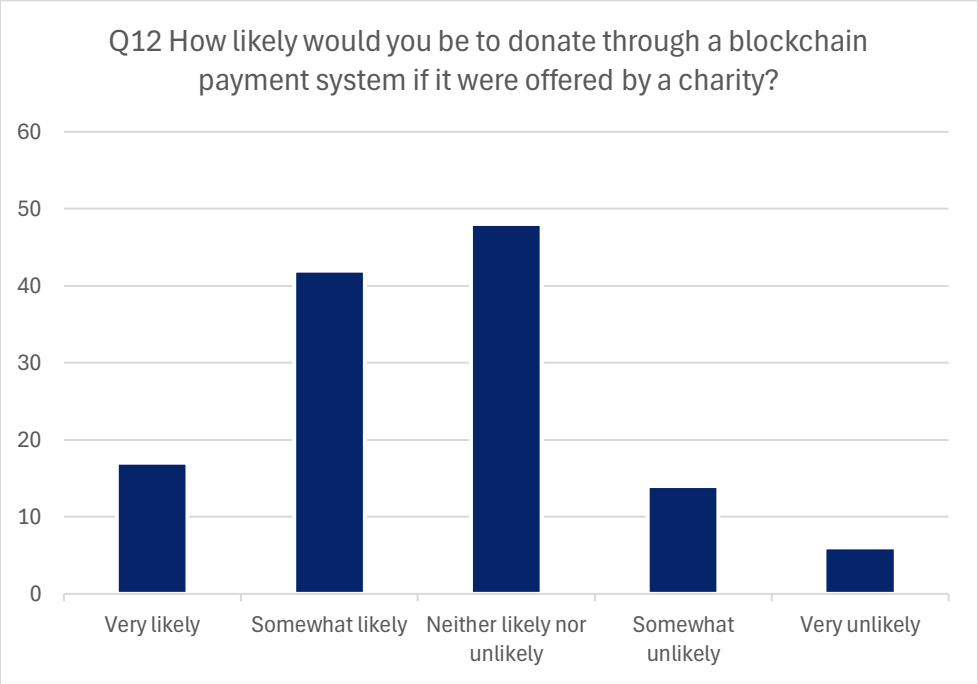
- Yes
- Maybe
- No



12

How likely would you donate through a blockchain payment system if it were offered by a charity? *

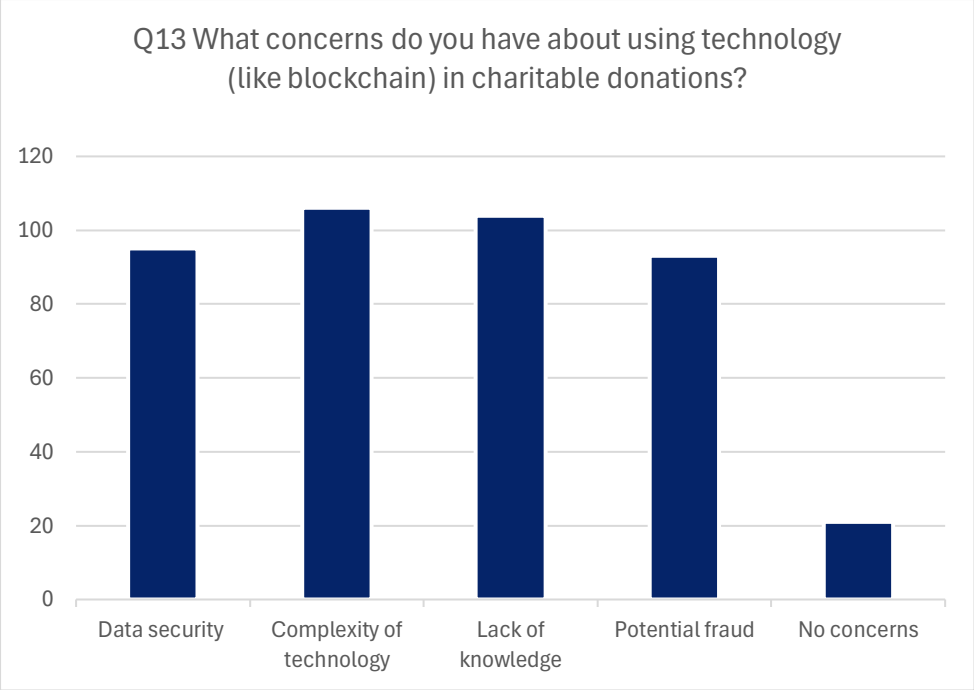
- ○ Very likely
- ○ Somewhat likely
- ○ Neither likely nor unlikely
- ○ Somewhat unlikely
- ○ Very unlikely



13

What concerns do you have about using technology (like blockchain) in charitable donations? *

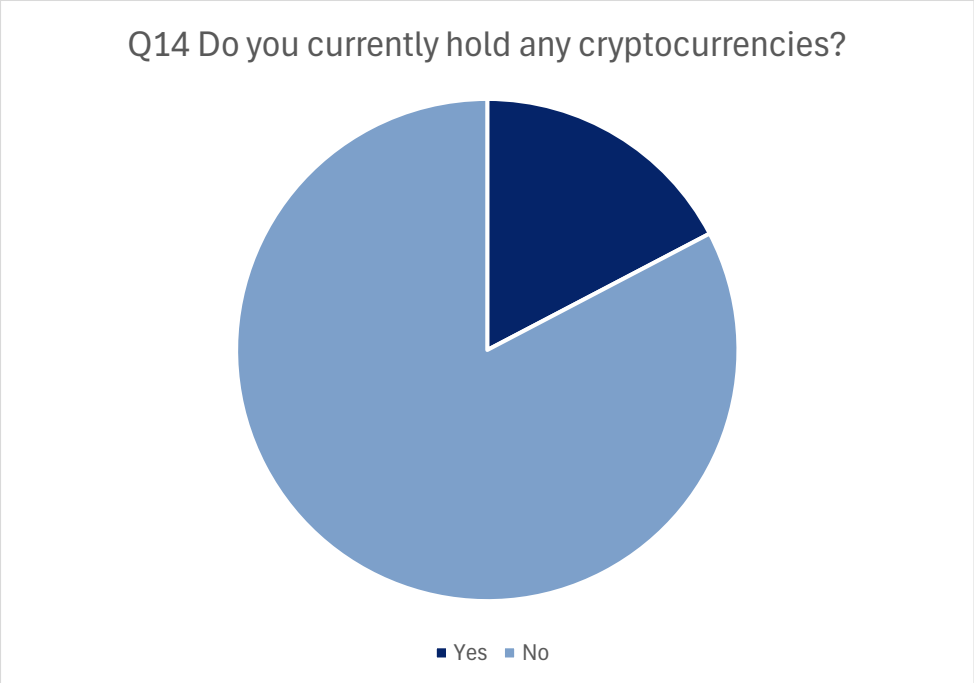
- ☐ Data security
- ☐ Complexity of technology
- ☐ Lack of knowledge
- ☐ Potential fraud
- ☐ No concerns



14

Do you currently hold any cryptocurrencies? *

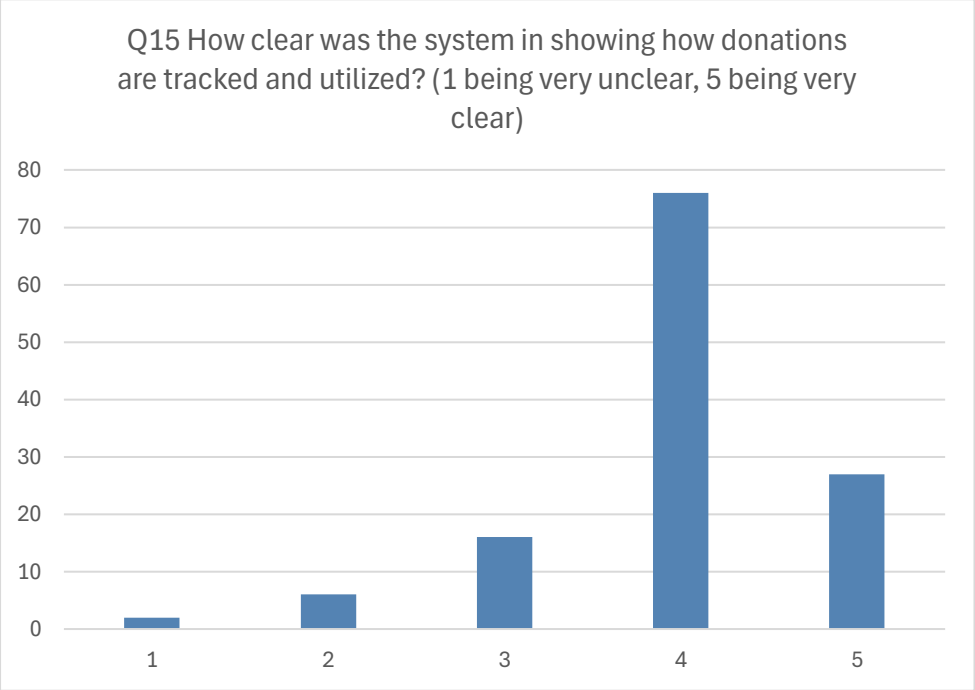
- Yes
- No



15

How clear was the system in showing how donations are tracked and utilized? (1 being very unclear, 5 being very clear) *

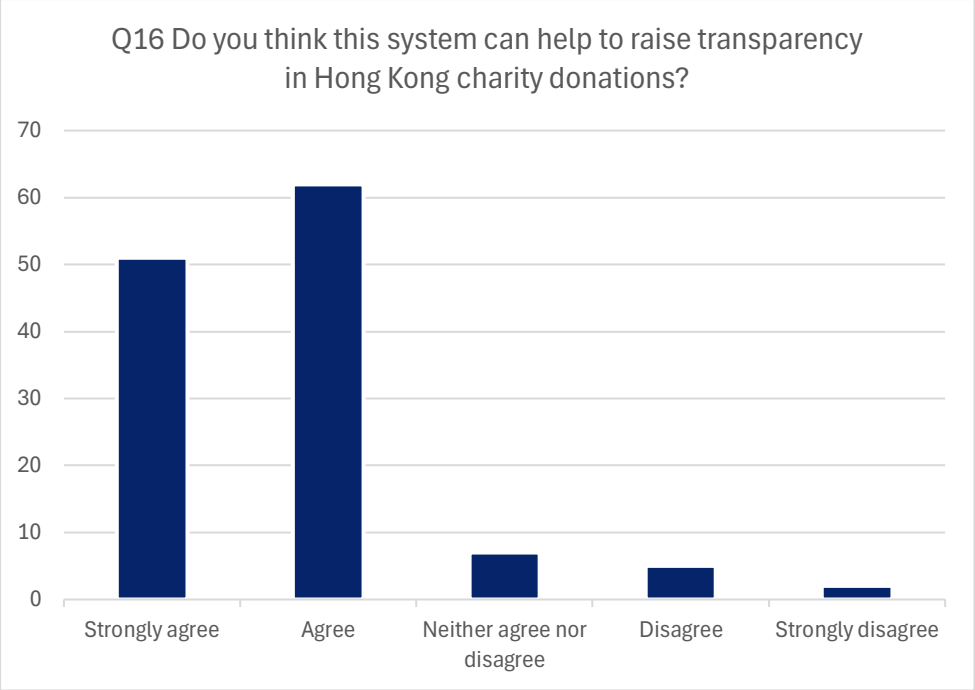
	1 (Very Unclear)	2	3	4	5 (Very Clear)
	○	○	○	○	○



16

Do you think this system can help to raise transparency in Hong Kong charity donations? *

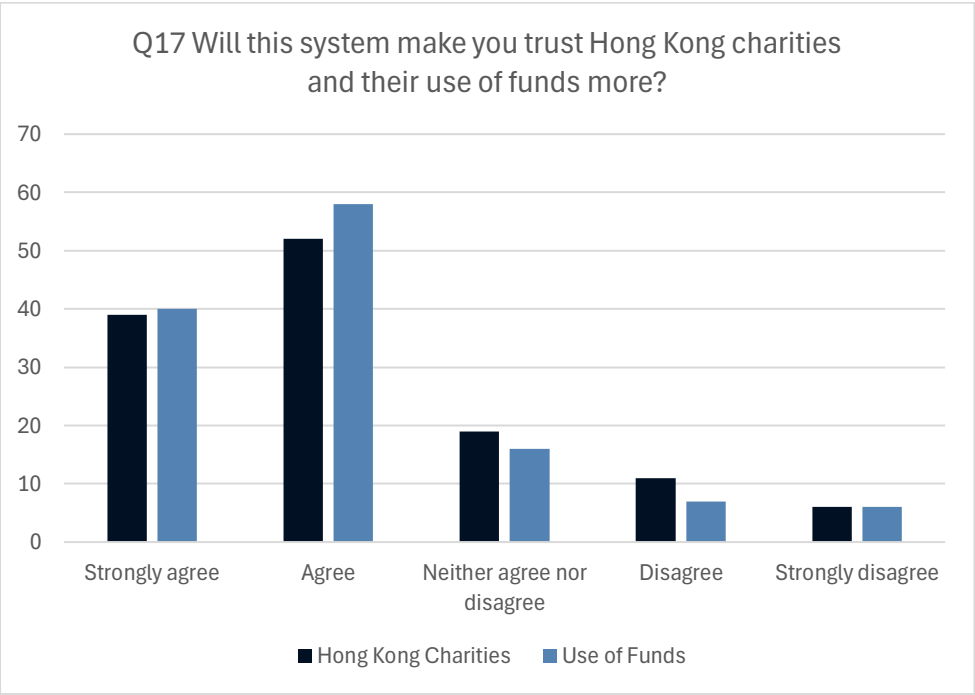
	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
	○	○	○	○	○



17

Will this system make you trust Hong Kong charities and their use of funds more? *

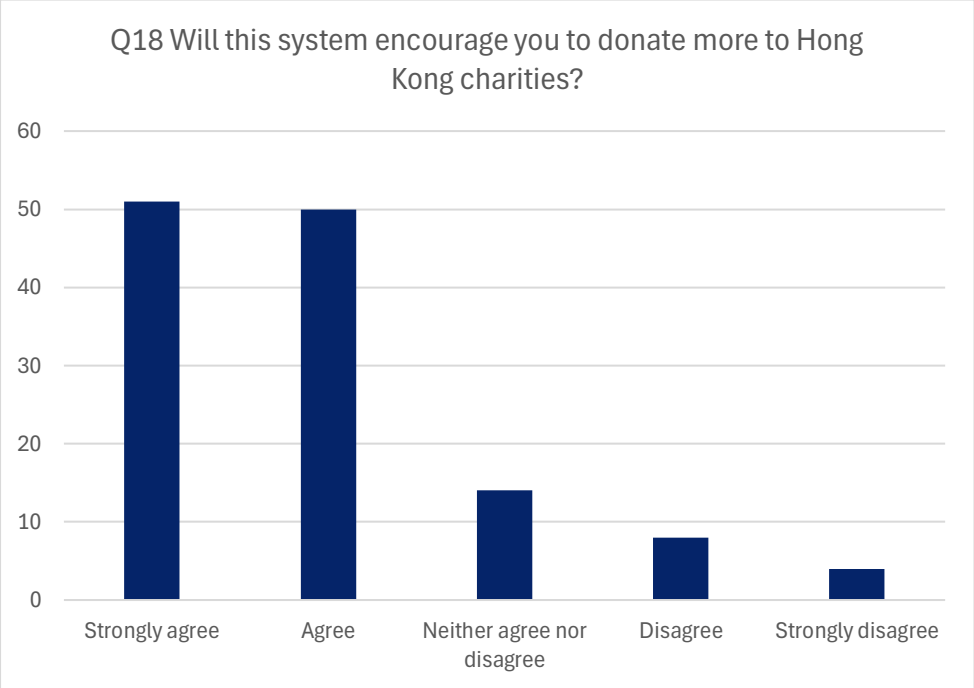
	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
Hong Kong Charities	○	○	○	○	○
Use of funds	○	○	○	○	○



18

Will this system encourage you to donate more to Hong Kong charities? *

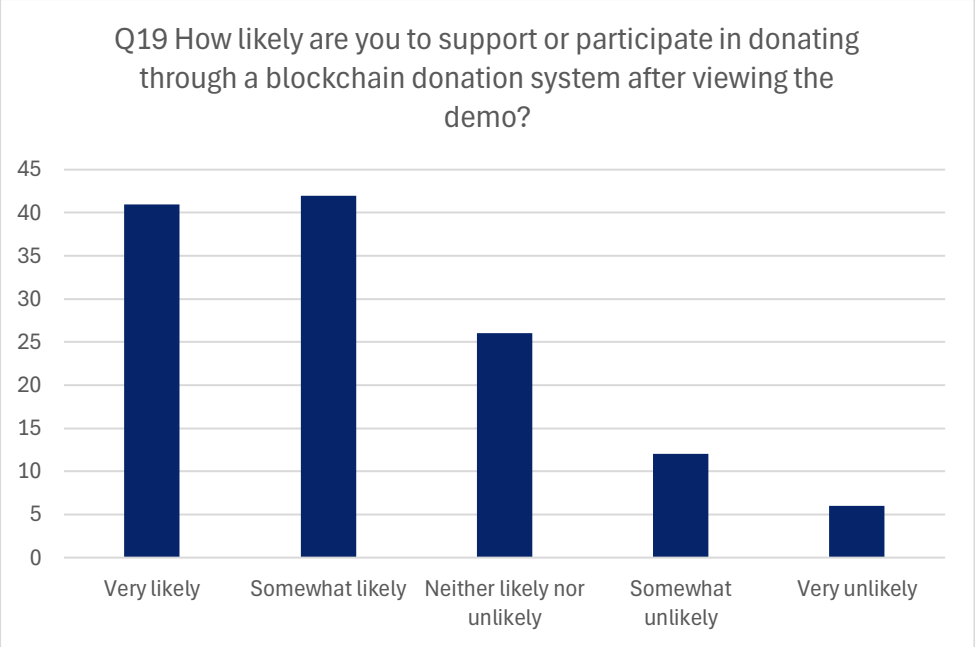
	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
	○	○	○	○	○



19

How likely are you to support or participate in donating through a blockchain donation system after viewing the demo? *

	Very likely	Somewhat likely	Neither likely nor unlikely	Somewhat unlikely	Very unlikely
	○	○	○	○	○



20

What additional features or improvements would you suggest for the blockchain donation system based on the demo? *

- [ ] More user-friendly interface
- [ ] Mobile application
- [ ] Community engagement features