TRANSPARENT CHARITY DONATION TRACKING

BACHELOR OF TECHNOLOGY

IN

COMPUTER SCIENCE AND ENGINEERING

Use Case Report

submitted by

Nippulapalli Triveni

(22501A05D1)

Under the guidance of

Mr. A. Prashant, Asst. Prof.

Department of Computer Science and Engineering

Prasad V Potluri Siddhartha Institute of Technology

(Permanently affiliated to JNTU-Kakinada, Approved by AICTE)

(An NBA & NAAC accredited and ISO 9001:2015 certified institute)

Kanuru, Vijayawada-520 007

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CERTIFICATE

This is to certify that the Use Case report entitled "Transparent Charity Donation Tracking" that is being submitted by N Triveni (22501A05D1), as part of Assignment-1 and Assignment-2 for the Blockchain Technology(20CS4601C) course in 3-2 during the academic year 2024-25.

Course Coordinator

Mr. A. Prashant

Assistant Professor,

Department of CSE,

Head of the Department

Dr. A. Jayalakshmi,

Professor and Head,

Department of CSE,

PVPSIT, Vijayawada

MARKS
ASSIGNMENT-1: ____/5
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1.INTRODUCTION

In traditional donation systems, donors send money to charities or non-profit organizations, which then distribute the funds to the intended recipients. However, this process often lacks transparency and accountability, leaving donors unaware of how their contributions are utilized. Transparency in this context means providing donors with a clear view of the donation journey, ensuring that funds reach the right people without unnecessary intermediaries (Tapscott & Tapscott, 2016) [4].

Blockchain technology offers a transformative solution to these challenges by introducing a decentralized, tamper-proof system for tracking donations. Blockchain records each transaction in a public ledger, making the donation path visible to all stakeholders. This means donors can verify that their contributions reach the intended recipients and see how the funds are spent (Buterin, 2014) [2].

Additionally, smart contracts — self-executing agreements encoded directly on the blockchain — play a crucial role in enhancing trust and automating the donation process. These contracts ensure that funds are released only when predefined conditions are met, removing the need for intermediaries and reducing the chances of fraud (Zamfir, 2015) [3]. As highlighted by Nakamoto (2008), the decentralized nature of blockchain prevents any single entity from controlling or manipulating the donation process, enhancing security and fairness [1].

By leveraging blockchain technology, the proposed system aims to create a transparent and trustworthy environment where every transaction is publicly recorded and verifiable. Donors gain peace of mind knowing that their funds are used as intended, while recipients benefit from instant access to donations without delays or deductions from third parties (Smith, 2019) [7]. This case study explores the use of blockchain in donation tracking, emphasizing transparency, accountability, and the empowerment of both donors and recipients through real-time financial traceability (Ghanem & Altman, 2018) [6].

2.BACKGROUND

Charity donations often have problems with transparency. In traditional systems, donors don't know exactly where their money goes or how charities use it. Because of this, people may lose trust, and the process can become slow and expensive, as the money passes through many middlemen before reaching those in need. These issues make some people doubt charities and hesitate to donate (Grassi, 2020) [9].

Blockchain technology, the foundation of cryptocurrencies like Bitcoin, offers a promising solution to these challenges. Blockchain functions as a digital ledger where all transactions are recorded in a transparent and immutable manner. This system allows donors to track their donations at every stage, ensuring that the funds are directed to the intended recipients (Nakamoto, 2008) [1]. By utilizing cryptocurrencies, donations can be sent directly from the donor to the charity, removing the need for intermediaries. This not only lowers transaction costs but also speeds up the donation process (Buterin, 2014) [2].

One of the major advantages of using cryptocurrency for donations is the enhanced transparency it provides. Donors can easily track their contributions, which builds greater trust in the charity's operations. Additionally, cryptocurrencies can be transferred across borders almost instantly, making them ideal for international donations where time-sensitive contributions are required (Rahman, 2021) [10].

However, despite the advantages, there are challenges to be addressed. Not all individuals are familiar with cryptocurrency, and some charities lack the infrastructure to accept digital currencies. Privacy concerns also arise, as cryptocurrencies can reveal more information than some donors may want to share (Swan, 2015) [5]. Furthermore, the value of cryptocurrencies can fluctuate significantly, which means the amount donated today could be worth less the following day, potentially affecting both donors and charities (Ghanem & Altman, 2018) [6].

Another key factor is the need for proper frameworks that help integrate blockchain into donation processes. As highlighted by the United Nations (2015) [8], technological innovation, when aligned with global initiatives like the Sustainable Development Goals (SDGs), can drive meaningful impact in areas like poverty reduction and financial inclusion. Blockchain's ability to provide transparent and direct financial assistance aligns closely with these goals, making it a promising solution for improving global donation systems.

Despite these challenges, the use of blockchain and cryptocurrency for charity donations holds significant potential. It promises to enhance transparency, reduce costs, and foster greater trust between donors and charities. As technology advances, it is expected that more charities will adopt these solutions, and the challenges will become easier to manage (Smith, 2019) [7].

3. BLOCKCHAIN BASICS

Blockchain technology plays a crucial role in making charity donations more transparent and secure. It acts as a digital ledger where every transaction is recorded and verified by a network of participants, ensuring funds go directly from donors to recipients without intermediaries (Nakamoto, 2008) [1].

Key concepts include:

3.1 Decentralization:

- No single authority controls the blockchain. Transactions are verified by multiple participants, ensuring transparency and reducing the risk of fraud (Buterin, 2014) [2].
- Donors can track their contributions in real time, promoting trust in the donation process (Tapscott & Tapscott, 2016) [4].

3.2 Immutability:

- Once recorded, donation data cannot be altered, ensuring records remain secure and tamper-proof (Nakamoto, 2008) [1].
- This prevents unauthorized changes and guarantees funds reach the right people as intended (Smith, 2019) [7].

3.3 Smart Contracts:

- Smart contracts automatically execute donation-related actions when predefined conditions are met, removing the need for intermediaries (Buterin, 2014) [2].
- For example, funds can be released only after the recipient submits proof of fund usage, ensuring accountability (Zamfir, 2015) [3].

3.4 Key Components:

- **Blocks:** Store transaction details like donor, recipient, and donation amount. Each block links to the previous one, forming a secure chain (Nakamoto, 2008) [1].
- **Hashing:** Ensures data integrity by generating unique identifiers for each block. Any change in data alters the hash, making tampering detectable (Swan, 2015) [5].
- **Consensus Mechanisms:** Validate transactions across the network, ensuring all participants agree on the donation details (Buterin, 2014) [2].

3.5 Advantages:

- **Transparency:** Donors can verify their contributions, ensuring funds are used as intended (Rahman, 2021) [10].
- **Security:** Transactions are encrypted, reducing the risk of fraud and unauthorized changes (Grassi, 2020) [9].
- **Efficiency:** Removing intermediaries lowers costs and speeds up the donation process, especially for international transfers (Tapscott & Tapscott, 2016) [4].

3.6 Use Cases:

- **Donor Tracking:** Donors can track how their funds are spent, ensuring transparency (Smith, 2019) [7].
- **International Donations:** Blockchain enables quick, low-cost cross-border transfers, making global donations easier (Rahman, 2021) [10].
- **Fraud Prevention:** Permanent records reduce the chances of fund misuse, enhancing trust (Ghanem & Altman, 2018) [6].

4. USE CASE OVERVIEW

This use case focuses on leveraging blockchain technology to enhance transparency and traceability in cryptocurrency-based charity donations. Traditional donation systems often lack transparency, with funds passing through multiple intermediaries before reaching the intended recipient, leading to delays and a lack of accountability. Blockchain technology offers a solution by ensuring that every transaction is publicly recorded and verifiable, reducing fraud and enhancing trust between donors and recipients (Tapscott & Tapscott, 2016) [4].

The key goals of this system are to:

- Provide donors and recipients with a secure, transparent system.
- Ensure that funds are used for their intended purpose.
- Reduce fraud and increase accountability in the donation process (Buterin, 2014) [2].

Key Workflow:

1. **Donor's Role:**
    - The donor sends cryptocurrency (e.g., Bitcoin, Ethereum) to a charity or recipient's wallet, which acts as a unique address for the transaction.
    - This donation is immediately recorded on the blockchain, ensuring immutability and transparency, making the donation traceable at every step (Nakamoto, 2008) [1].
2. **Blockchain Tracking:**
    - The blockchain serves as a public ledger that records donation transactions in real-time.
    - Each donation is timestamped, and transaction details like the donation amount, donor's wallet address, and recipient's wallet address are permanently stored. This ensures the movement of funds can be tracked securely and transparently by all parties involved (Swan, 2015) [5].
3. **Smart Contracts:**
    - Upon donation, a smart contract is triggered that defines the conditions for fund release.
    - The contract requires the recipient to submit documentation (e.g., bills or receipts) proving the funds are used for the intended purpose (Zamfir, 2015) [3].
    - Once the required evidence is verified, the smart contract automatically releases the funds, ensuring that donations are only used as promised, thus increasing transparency and reducing misuse (Rahman, 2021) [10].

4. **Recipient's Role:**
    - The recipient submits necessary proof (invoices, bills, or receipts) verifying that the funds were used as intended.
    - Once the smart contract validates this proof, funds are either released to the recipient's wallet or converted into local currency for immediate use (Smith, 2019) [7].
5. **Feedback and Accountability:**
    - To maintain transparency, recipients are encouraged to post feedback that includes bills, receipts, or reports detailing how the funds were spent.
    - This feedback is stored on the blockchain, ensuring transparency and allowing donors to verify the impact of their contributions. Such measures foster trust and confidence in the charity or recipient, creating a transparent loop of giving and accountability (Ghanem & Altman, 2018) [6].

Technology Used:

- **Blockchain:** Acts as an immutable ledger that records all donation transactions, ensuring accountability (Nakamoto, 2008) [1].
- **Smart Contracts:** Automate fund transfers and verify donation conditions before releasing funds, preventing misuse (Buterin, 2014) [2].
- **Cryptocurrency:** Provides a secure method for transferring funds directly between donors and recipients, reducing the need for intermediaries and cutting costs (Grassi, 2020) [9].

This blockchain-based system significantly improves the transparency and traceability of donations. Donors can track every step of their contributions, while recipients benefit from instant access to funds. Through smart contracts and real-time verification, this system builds a high level of trust and accountability, ensuring every coin donated makes the intended impact (Rahman, 2021) [10].

5.IMPLEMENTATION

5.1 Define the Donation Workflow

- Step 1: Identify Stakeholders
    - Donors: People who donate funds.
    - Recipients: People who receive the funds after verification.
    - Smart Contracts: Automate the donation process, bill verification, and fund release.
    - Cryptocurrency Wallets: Send and receive funds.
    - Verification Authorities: Verify the submitted bills before releasing funds.
- Step 2: Determine Data to be Stored
    - Transaction ID: Each donation gets a unique ID.
    - Donor's Address: The wallet address of the person donating.
    - Recipient's Address: The wallet address of the person receiving funds.
    - Amount Donated: The donation amount.
    - Timestamp: The time when the donation happened.
    - Transaction Status: Tracks whether funds are released or not.
    - Bill/Receipt Details: Keeps proof of bill submission and verification.
- Step 3: Define Key Operations
    - Donation Confirmation (donate):
        - Donors send funds to the smart contract.
        - The contract records the donor's address, donation amount, and timestamp.
        - Emits a DonationReceived event to notify the blockchain.
    - Bill Submission (submitBill):
        - The donor submits a bill (proof) after making the donation.
        - The contract stores the bill proof and emits a BillSubmitted event.
    - Bill Verification (verifyBill):
        - Only the admin or owner can verify the bill.
        - The contract marks the bill as verified and emits a BillVerified event.

- Funds Transfer (releaseFunds):
  - After bill verification, only the admin or owner can release the funds.
  - The contract transfers the donation amount to the recipient and emits a FundsReleased event.

Example Solidity Code for Donation Tracking:

```
// SPDX-License-Identifier: MIT
pragma solidity ^0.8.0;
contract DonationTracking {
    // State variables
    address public owner;
    address public admin;  // Trusted admin address
    // Donation structure to track donations
    struct Donation {
        uint amount;
        address donor;
        uint timestamp;
        bool released;
        bool billSubmitted;
        bool billVerified;  // New flag to track if the bill was verified
        string billProof;   // Store the bill proof (could be a URL or IPFS hash)
    }
    mapping(uint => Donation) public donations;
    uint public donationCount;
    // Events
    event DonationReceived(uint donationId, address donor, uint amount, uint timestamp);
    event FundsReleased(uint donationId, address recipient);
    event BillSubmitted(uint donationId, string billProof);
    event BillVerified(uint donationId, bool verified);
    // Constructor to set the owner and admin addresses
    constructor(address _admin) {
```

```
        owner = msg.sender;  // Set the contract deployer as the owner
        admin = _admin;      // Set a trusted admin address
    }
    // Modifier to ensure that only the owner or admin can execute certain functions
    modifier onlyAuthorized() {
        require(msg.sender == owner || msg.sender == admin, "Not authorized");
        _;  // Allow the rest of the function to execute
    }
    // Donate function: Anyone can donate to the contract
    function donate() public payable {
        require(msg.value > 0, "Donation amount must be greater than zero");
        donationCount++;
        donations[donationCount] = Donation(
            msg.value,
            msg.sender,
            block.timestamp,
            false,
            false,
            false,
            ""
        );
        emit DonationReceived(donationCount, msg.sender, msg.value, block.timestamp);
    }
    // Submit a bill function: Only the donor can submit the bill proof
    function submitBill(uint _donationId, string memory _billProof) public {
        require(msg.sender == donations[_donationId].donor, "Only the donor can submit the
bill");
        require(!donations[_donationId].released, "Funds already released");
        donations[_donationId].billSubmitted = true;
        donations[_donationId].billProof = _billProof;
```

```
        emit BillSubmitted(_donationId, _billProof);
    }
    // Verify the bill function: The admin or a trusted entity can verify the bill
    function verifyBill(uint _donationId, bool _verified) public onlyAuthorized {
        require(donations[_donationId].billSubmitted, "Bill not submitted yet");
        donations[_donationId].billVerified = _verified;
        emit BillVerified(_donationId, _verified);
    }
    // Release funds after bill verification: Only the owner or admin can release funds
    function releaseFunds(uint _donationId, address _recipient) public onlyAuthorized {
        require(donations[_donationId].billVerified, "Bill not verified");
        require(!donations[_donationId].released, "Funds already released");
        donations[_donationId].released = true;
        payable(_recipient).transfer(donations[_donationId].amount);
        emit FundsReleased(_donationId, _recipient);
    }
}
```

Fig. 5.1.1 shows that, the donation process begins when the donor sends Ether (cryptocurrency) to the smart contract to make a donation. Upon receiving the funds, the smart contract records the donation details, such as the donor's address and the amount donated. It then emits an event to the blockchain, serving as a notification that the donation has been recorded.

Next, the recipient submits a bill or request to the smart contract to access the donated funds. The smart contract validates the bill to ensure it meets the required conditions. If the bill is approved, the smart contract releases the necessary funds to the recipient. Simultaneously, another event is emitted to the blockchain, confirming that the funds have been released. Finally, the recipient receives the funds and confirms the transaction, completing the donation process.

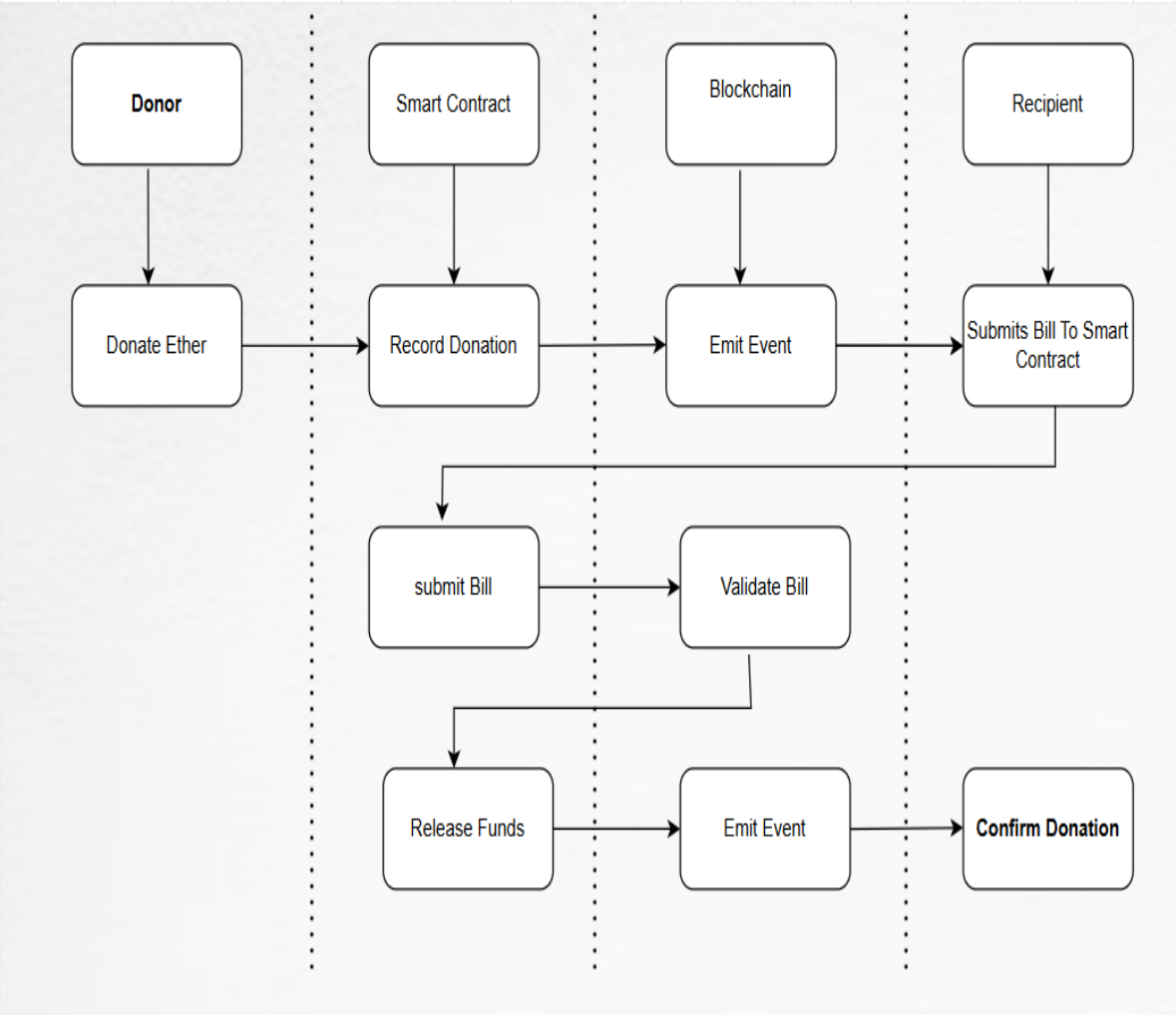

Fig. 5.1.1 Flow Diagram of Transparent Donation Tracking System Using Blockchain

6. BENEFITS

6.1 Enhanced Transparency

- **Real-time Tracking:** Donors can track contributions from donation to fund utilization, ensuring complete transparency.
- **Immutable Records:** Transactions are permanently recorded on the blockchain, preventing tampering and building trust.

6.2 Improved Traceability

- **End-to-End Tracking:** Donations are traceable from the moment they're made until they reach recipients.
- **Auditability:** Creates a verifiable audit trail, simplifying checks on fund allocation and preventing discrepancies.

6.3 Enhanced Security

- **Cryptographic Protection:** Ensures data integrity through encryption, preventing unauthorized access.
- **Distributed Ledger:** Data is stored across multiple nodes, reducing the risk of cyberattacks.

6.4 Reduced Fraud and Misuse

- **Transparent Transactions:** Every donation and expense is publicly recorded, minimizing fund misappropriation.
- **Bill Verification:** Smart contracts validate submitted bills before fund release, ensuring proper usage.

6.5 Better Collaboration

- **Shared Visibility:** Donors, recipients, and charities access the same data, enhancing cooperation.
- **Smart Contracts:** Automates processes like donation recording and fund release, reducing delays.

6.6 Increased Efficiency

- **Faster Processing:** Automation reduces paperwork, making fund transfers quick and efficient.
- **Instant Fund Release:** Smart contracts instantly release funds once verification conditions are met.

6.7 Improved Compliance and Reporting

- **Accurate Records:** Ensures precise recording of donations, aiding regulatory compliance.
- **Simplified Audits:** Provides consistent, transparent records, easing regulatory checks.

6.8 Donor Trust and Engagement

- **Visible Impact:** Donors can see how their money is spent, enhancing trust and encouraging repeat contributions.
- **Proof of Impact:** Charities provide verifiable proof of their work, strengthening credibility.

6.9 Cost Savings

- **Reduced Administrative Costs:** Automation minimizes intermediaries and paperwork, cutting expenses.
- **Fraud Prevention:** Reduces financial losses by preventing fund misuse.

6.10 Sustainability

- **Paperless Transactions:** Reduces reliance on physical records, promoting eco-friendly processes.
- **Resource Optimization:** Real-time tracking helps allocate resources efficiently, minimizing waste.

7. CHALLENGES

7.1 Scalability Issues

- **Transaction Speed:** Public blockchains can slow down with increased transactions.
- **Network Congestion:** High activity can lead to delays and increased gas fees.

7.2 High Initial Costs

- **Setup Expenses:** Implementing blockchain requires investment in development and integration.
- **System Integration:** Adapting existing donation platforms to blockchain can be complex.

7.3 Data Privacy Concerns

- **Donor Anonymity:** Public ledgers make privacy harder to maintain for donors.
- **Recipient Privacy:** Protecting recipient data while ensuring transparency is challenging.

7.4 Adoption and Standardization Challenges

- **No Universal Standards:** Different platforms operate with varied protocols, creating interoperability issues.
- **Resistance to Change:** Charities may hesitate to adopt new technology due to technical complexity.

7.5 Complexity in Data Entry and Maintenance

- **Human Error:** Incorrect data input can affect donation tracking accuracy.
- **Verification Challenges:** Ensuring proper validation of bills and receipts adds complexity.

7.6 Regulatory and Legal Challenges

- **Legal Uncertainty:** Varying global regulations create compliance challenges.
- **Data Protection Laws:** Storing sensitive donor and recipient data on-chain may conflict with privacy laws.

7.7 Energy Consumption

- **High Power Usage:** Proof-of-Work blockchains consume significant energy, raising sustainability concerns.
- **Alternative Solutions:** Transitioning to energy-efficient systems like Proof-of-Stake requires investment.

7.8 Interoperability Issues

- **Platform Differences:** Integrating different blockchain protocols is challenging.
- **Payment Compatibility:** Bridging traditional payment systems with crypto donations requires additional infrastructure.

7.9 Lack of Skills and Expertise

- **Shortage of Talent:** Blockchain implementation demands specialized knowledge, which can be hard to find.
- **Training Needs:** Educating charity staff and recipients about the system is essential.

7.10 Public vs. Private Blockchain

- **Transparency vs. Privacy:** Public chains provide openness but expose sensitive data, while private chains limit visibility.

7.11 Network and System Downtime

- **Reliability Risks:** Network outages or smart contract failures could disrupt donation processing.

7.12 Adoption by All Stakeholders

- **Technical Barriers:** Many charities and recipients lack the resources or knowledge to adopt blockchain solutions.
- **Participation Gaps:** The system works best when all stakeholders are onboard, which isn’t always guaranteed.

8.CONCLUSION

Blockchain technology has the potential to revolutionize charity donation processes by offering a secure, transparent, and efficient system for tracking every transaction. By eliminating traditional intermediaries, blockchain allows donors to verify each donation in real time and ensures that funds reach the intended recipients without unnecessary delays [1][2]. Smart contracts further enhance the process by automating fund transfers only when predefined conditions are met, thereby reducing the risk of fraud and misuse [3][4].

Additionally, blockchain's immutable ledger maintains a permanent record of every donation, which builds trust and accountability among donors, charities, and recipients [5][7]. Although challenges such as scalability, fluctuating cryptocurrency values, data privacy, and regulatory compliance remain [6][8], the long-term benefits—including lower transaction costs, faster fund transfers, and increased donor confidence—make blockchain a promising tool for transforming charitable giving [10].

In summary, integrating blockchain technology into the charity donation process can create a more transparent and accountable ecosystem. As stakeholders collaborate to overcome current challenges, blockchain will help ensure that every contribution is used effectively, ultimately supporting global efforts to reduce poverty and improve financial inclusion [8][9].

9. SDG'S ADDRESSED

Using blockchain for charity donation tracking can help address several of the United Nations Sustainable Development Goals (SDGs) by improving efficiency, accountability, and transparency in the donation process. Below are the UN SDGs that blockchain technology can support, along with justifications for each:

SDG 1: No Poverty
Blockchain ensures that donations reach the intended beneficiaries directly, minimizing the risk of funds being misused or diverted. This promotes fair distribution of resources and helps support poverty reduction efforts.

SDG 8: Decent Work and Economic Growth
Blockchain can track donations aimed at supporting livelihood programs and economic empowerment projects. Transparent fund allocation ensures workers and communities benefit directly, promoting fair practices and economic growth.

SDG 9: Industry, Innovation, and Infrastructure
Blockchain introduces innovative ways to manage donations by providing real-time tracking and secure data sharing. It enhances the efficiency and reliability of donation processes, encouraging technological advancement in charitable operations.

SDG 12: Responsible Consumption and Production
Blockchain can verify that donations are used responsibly by providing a transparent record of fund allocation. This helps donors ensure their contributions support sustainable practices and reduce wastage.

SDG 16: Peace, Justice, and Strong Institutions
Blockchain's transparency and immutability create tamper-proof records of donation flows, reducing fraud and corruption. This strengthens trust in charitable institutions and ensures accountability in the donation process.

SDG 17: Partnerships for the Goals
Blockchain fosters collaboration between charities, governments, and donors by providing a shared, transparent platform for tracking donations. This promotes partnerships and enhances collective efforts to achieve global development goals.

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11.APPENDIX A

https://drive.google.com/drive/u/0/folders/1uqAXgNQO0JXTUM3r9WdqFHH0zOtrMG_R