

BlockChain Based Transparent Orphanage Support System

Madhurani M
Assistant Professor (SG)
Department of Information
Technology
Rajalakshmi Engineering
College,
Rajalakshmi Nagar, Thandalam,
Chennai, India.
madhurani.m@rajalakshmi.edu.in

Dr. A Jawahar
Professor
Department of Electronics and
Communication Engineering
Sri Sivasubramaniya nadar
College
of Engineering, Kalavakkam,
Chennai, India.
jawahara@ssn.edu.in

Abishek T
Department of Information
Technology
Rajalakshmi Engineering
College,
Rajalakshmi Nagar, Thandalam,
Chennai, India.
221001006@rajalakshmi.edu.in

David Megan C
Department of Information
Technology
Rajalakshmi Engineering
College,
Rajalakshmi Nagar, Thandalam,
Chennai, India.
221001037@rajalakshmi.edu.in

Abstract: The Transparent Orphanage Support System (TOSS) is a blockchain-powered welfare platform designed to enhance transparency, accountability, and trust in donations and healthcare record management. Orphanages often face challenges such as opaque fund utilization and unreliable health records, which reduce donor confidence and long-term support. TOSS integrates donation tracking, medical record verification, and donor engagement into a unified system. Using blockchain immutability, smart contracts, and decentralized storage, donations are tracked end-to-end, while health records are digitally signed by doctors and stored securely. Donors are provided real-time dashboards that show how contributions impact children's welfare in education, nutrition, and healthcare. This paper presents the motivation, literature survey, system design, functional requirements, methodologies, and future enhancements of TOSS, highlighting its potential as a scalable and trustworthy welfare management system.

Keywords: Blockchain, Smart Contracts, Donation Transparency, Healthcare Informatics, Child Welfare.

1. INTRODUCTION

Orphanages and welfare institutions face persistent challenges in managing donations and maintaining reliable healthcare records for children. A lack of transparency in how funds are utilized discourages long-term donor engagement, while tampered or missing health records compromise accountability and hinder proper care. Existing donation platforms provide receipts but fail to offer end-to-end visibility of fund allocation, and orphanage record systems rarely include verified medical data. These limitations weaken trust between donors, welfare organizations, and other stakeholders. The Transparent Orphanage Support System (TOSS) addresses these issues by integrating blockchain, smart contracts, and healthcare informatics into a unified platform. All donations are recorded in a

tamper-proof blockchain ledger, while smart contracts ensure funds are released only for approved activities such as food, education, and healthcare. Children's medical records are digitally signed by doctors and stored securely, making them authentic and resistant to manipulation. By combining donation transparency with healthcare verification, TOSS builds trust and accountability across NGOs, doctors, donors, and auditors. A key feature of TOSS is its donor dashboard, which provides real-time insights into the utilization and impact of contributions. Donors can track how their funds are used, view healthcare updates, and assess improvements in education and nutrition for supported children. This transparent interaction fosters stronger relationships between donors and welfare institutions, ensuring sustained support. Unlike existing systems, TOSS secures financial and medical accountability

while offering a scalable framework extendable to NGOs, hospitals, schools, and global welfare projects.

2. LITERATURE SURVEY

Several studies form the foundation of TOSS. Research on blockchain-based charitable donation systems [2][3][20] demonstrates how Ethereum and smart contracts can ensure secure, transparent, and traceable donation flows. Healthcare-focused studies [5][7] propose blockchain-enabled EHR systems and cloud-based frameworks that ensure secure and interoperable health data management. Federated learning approaches [4][12] allow AI-driven healthcare analytics without centralizing sensitive data, which is critical for privacy in child welfare. Access control mechanisms such as Attribute-Based Access Control (ABAC) and Role-Based Access Control (RBAC) [8][10] improve security in health IoT systems, while decentralized identity models [17][18] strengthen authentication. Edge-based IoMT systems [13][14] provide real-time health monitoring with reduced latency. A systematic review of scalability issues [19] highlights the importance of hybrid blockchain frameworks to handle large-scale deployments. Although these works provide valuable insights, most address either donations or healthcare separately. TOSS fills this gap by integrating donation transparency, healthcare verification, and donor engagement into one ecosystem.

3. RESEARCH GAP

The systems currently used by orphanages and welfare organizations suffer from significant limitations in both donation management and healthcare record-keeping. Popular donation platforms such as GoFundMe, GiveIndia, and similar services enable donors to transfer funds and receive receipts, but they provide little to no information about how the donations are actually spent. Donors cannot verify whether their contributions are used for essential services such as food, education, or healthcare, which creates mistrust and reduces the likelihood of sustained support. The absence of end-to-end visibility makes the donation process opaque and often leads to misuse of funds. On the

other hand, most orphanage record management systems are designed only to handle basic administrative tasks such as admissions, staff details, or general child information. These systems do not include functionality for managing verifiable healthcare data. Medical records, when maintained, are often stored in centralized databases or on paper, making them vulnerable to tampering, unauthorized access, or permanent loss. There is rarely any form of doctor verification, and thus the authenticity of health records is questionable. Another weakness of existing systems is their fragmented nature. Donation platforms, record-keeping systems, and healthcare databases usually operate in isolation, with no integrated mechanism to provide transparency across financial and medical data. This lack of integration results in inefficiencies, poor monitoring, and limited engagement between donors and welfare institutions. Consequently, donors are unable to see the real impact of their contributions, auditors cannot track resource allocation effectively, and children in orphanages do not always receive the benefits intended for them.

4. PROPOSED SYSTEM

The Transparent Orphanage Support System (TOSS) is proposed as a blockchain-based platform that integrates donation tracking, healthcare record management, and donor engagement into a unified and transparent framework. Unlike traditional systems, TOSS ensures that every donation is recorded on a blockchain ledger, making transactions immutable, auditable, and tamper-proof. Smart contracts are used to automate the allocation of funds, ensuring that money is released only for pre-approved purposes such as food, education, medical treatment, or infrastructure support. This automation reduces human error and eliminates the possibility of funds being misused for unauthorized activities. A key feature of the proposed system is the inclusion of healthcare record management. Doctors are given secure access to upload and digitally sign medical reports of children, which are then stored in the InterPlanetary File System (IPFS). The blockchain records a hash of each report, providing an immutable

proof of authenticity. This approach not only protects the privacy and integrity of medical data but also guarantees that reports cannot be altered once verified. Authorized users such as NGOs, donors, and auditors are given controlled access to these records, ensuring transparency without compromising data confidentiality. TOSS also enhances donor engagement through a real-time dashboard. Donors can log in to view how their funds are being utilized, track the progress of children they support, and monitor key areas such as healthcare improvements, educational milestones, and nutritional support. Notifications and updates provide additional assurance of transparency, fostering stronger trust between donors and welfare institutions. By integrating donation accountability with verified healthcare monitoring, the proposed system addresses the weaknesses of existing platforms and creates a scalable model that can be extended to multiple orphanages, NGOs, hospitals, and schools. In doing so, TOSS establishes itself as a socially impactful and technologically sustainable solution for global welfare management.

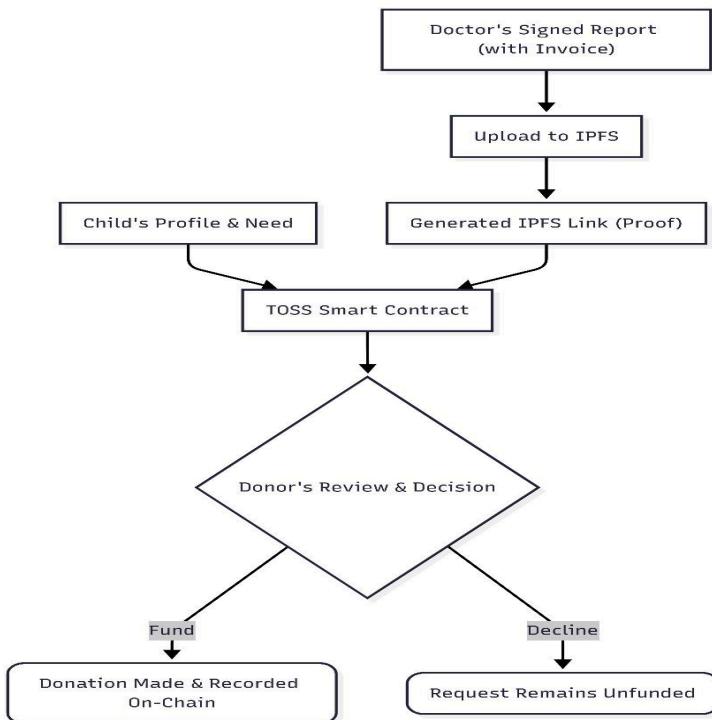


Fig 1. System Flow Diagram

5. ARCHITECTURE DESIGN

The system is designed to bring transparency into a donation process where doctors, donors, and administrators interact through different portals. Doctors submit proofs such as medical records or treatment needs, which are important for validating fund usage. Donors and administrators access the system through web or mobile applications, where they first go through an authentication process to ensure only verified users can participate. This separation of roles ensures that doctors provide data, donors contribute funds, and administrators oversee the process.

Once authenticated, all user interactions pass through a backend system that handles the core application logic. The backend uses an authentication service for secure login, an API Gateway built on Node.js/NestJS for routing requests, and a backend application that coordinates operations. This application connects with two key systems: the blockchain network for transaction and contract management, and IPFS for storing and retrieving large files such as medical proofs. By combining blockchain and IPFS, the system ensures both data transparency and secure decentralized storage.

The blockchain layer operates through specialized smart contracts. These contracts manage different aspects of the process: handling donations, releasing funds, maintaining a verified list of doctors, and enforcing access control for various roles. All transactions are recorded on the blockchain network, providing an immutable and tamper-proof history. The validated data is then used to update a donor dashboard, which allows contributors to monitor where their funds are going and how they are being used. This closes the loop by ensuring donors can track the impact of their contributions, fostering trust and accountability.

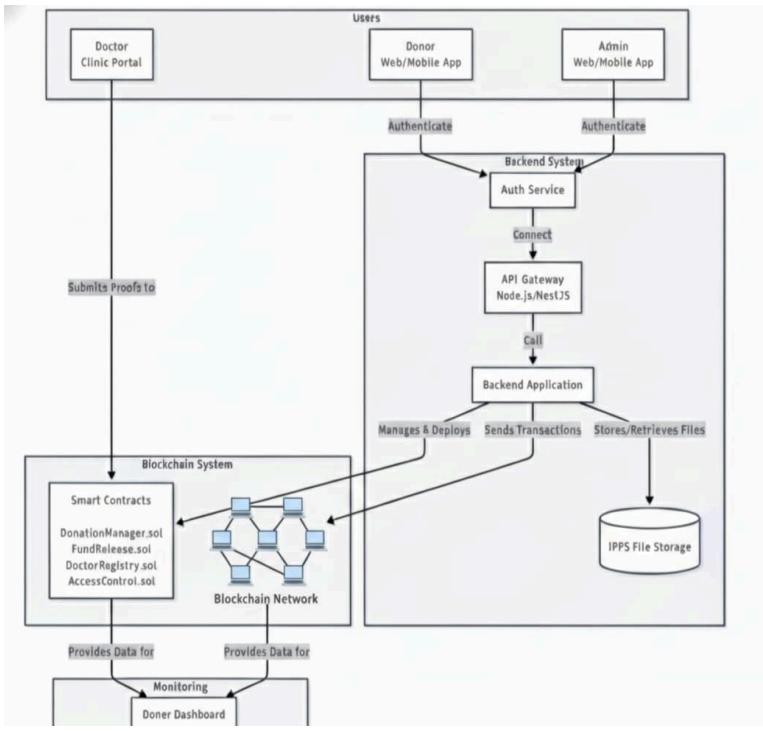


Fig 2. Architecture Diagram

6. DEPLOYMENT

1. Smart Contract - Permissioned Transaction

This interface acts as the automated and transparent rulebook for the entire system, running on the blockchain. It consists of two main parts: a registry contract that keeps a secure list of all verified Admins and Doctors, and a core contract that manages the entire lifecycle of a donation, from creating a child's profile to releasing funds. This module is the decentralized backend and rulebook for the system.

Algorithm: RoleBasedAccess_SmartContract

BEGIN

```

// Step 1: Start
    RECEIVE transaction(senderAddress,
functionName, parameters)
// Step 2: Verify Role
    CALL
VerifiedRegistry.isVerifiedAdmin(senderAddress) →
isAdmin
// Step 3: Authorize or Reject
IF isAdmin == FALSE THEN
    RETURN ERROR "Caller is not a verified

```

admin"

```

STOP EXECUTION
END IF
// Step 4: Execute Logic
IF functionName == "createChildProfile" THEN
    name ← parameters.name
    age ← parameters.age
    story ← parameters.story
    newProfile ← ChildProfile(name, age, story,
senderAddress)
// Step 5: Record State Change
STORE newProfile INTO blockchainStorage
END IF
// Step 6: Emit Event
EMIT Event ChildProfileCreated(senderAddress,
name, age, story)
// Step 7: End
RETURN SUCCESS "Child profile created
successfully"
END

```

2. Admin Interface

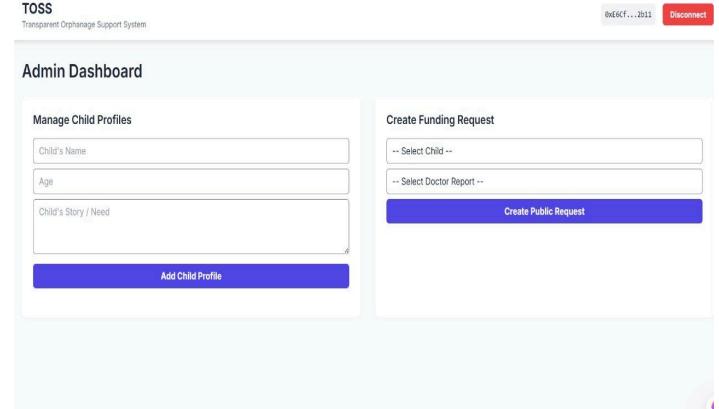


Fig 3. Admin Interface

This interface is the control center for the NGO or orphanage staff. An admin connects their verified digital wallet to log in. First, they create a profile for a child in their care, which is permanently saved to the blockchain. Later, when a doctor has submitted a medical report for that child, the admin can create a public funding request by linking the child's profile to the specific doctor's report. This module is the control center for the NGO or orphanage staff.

```

Algorithm: Admin_ChildFunding_Workflow
BEGIN
    // Step 1: Start
    Admin connects wallet to TOSS app
    // Step 2: Authenticate
    IF NOT
        VerifiedRegistry.isVerifiedAdmin(adminWalletAddress) THEN
            RETURN "Access denied: Not a verified admin"
        END IF
    // Step 3: Create Child Profile
    Admin submits childDetails
    CALL createChildProfile(childDetails)
    WAIT for wallet confirmation
    RECORD ChildProfile on blockchain
    EMIT ChildProfileCreated
    // Step 4: Create Funding Request
    DISPLAY verified children & doctor reports
    Admin selects child and report
    CALL createFundingRequest(selectedChild, doctorReport)
    WAIT for wallet confirmation
    RECORD FundingRequest on blockchain
    EMIT FundingRequestCreated
    // Step 5: End
    RETURN "Operations completed successfully"
END

```

3. Doctor Interface

This interface allows verified medical professionals to provide authentic proof of a child's needs. A doctor connects their verified digital wallet to access their dashboard. They select a child from the system, enter the diagnosis and estimated treatment cost, and upload a signed medical document. The system securely stores this document in a decentralized way and records its unique, tamper-proof fingerprint on the blockchain. This module allows verified medical professionals to provide authentic proof of a child's needs.

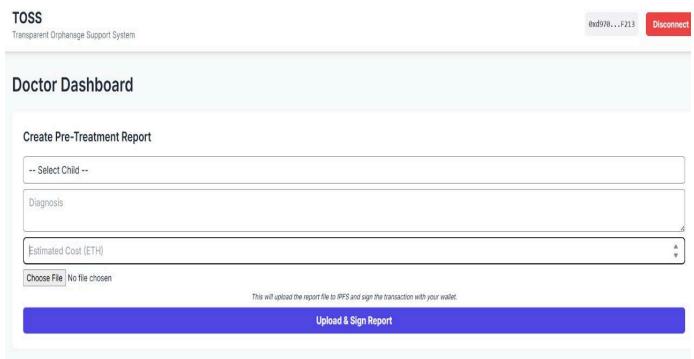


Fig 4. Doctor Interface

Algorithm: Doctor_ReportSubmission_Workflow

```

BEGIN
    // Step 1: Start
    Doctor connects wallet to TOSS app
    // Step 2: Authenticate
    IF NOT
        VerifiedRegistry.isVerifiedDoctor(doctorWalletAddress) THEN
            RETURN "Access denied: Not a verified doctor"
        END IF
    // Step 3: Provide Proof
    DISPLAY verified child list
    Doctor selects selectedChild
    Doctor enters diagnosis, cost, and uploads medicalDocument
    // Step 4: Upload and Sign Transaction
    UPLOAD medicalDocument TO IPFS → cid
    CALL createDoctorReport(selectedChild, diagnosis, cost, cid)
    PROMPT doctor to confirm transaction
    IF transaction CONFIRMED THEN
        RECORD report on blockchain
        EMIT
            DoctorReportCreated(doctorWalletAddress, selectedChild)
    END IF

```

```

ELSE
    RETURN "Transaction canceled by user"
END IF
// Step 5: End
RETURN "Doctor report successfully submitted"
END

```

4. Donation Management Interface

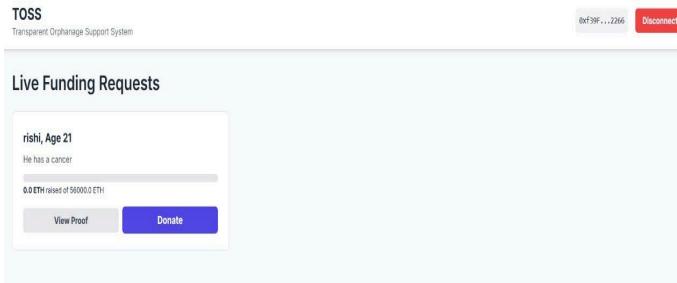


Fig 5. Donor Interface

This interface facilitates the transparent flow of funds from donors. A donor browses the list of active funding requests. When they choose to contribute, they specify an amount and confirm the donation using their digital wallet. The smart contract automatically receives the funds, updates the progress bar for that specific request, and creates a permanent, public record of the donation. This module facilitates the secure and transparent flow of funds.

Algorithm: Donor_Funding_Workflow

```

BEGIN
// Step 1: Start
Donor connects wallet to TOSS portal
// Step 2: View Needs
FETCH activeFundingRequests FROM
TOSSCore
DISPLAY requests TO donor
// Step 3: Initiate Donation
Donor selects selectedRequest AND enters
donationAmount
// Step 4: Execute Transaction
CALL donate(selectedRequest, donationAmount)
PROMPT donor to confirm transaction
IF transaction CONFIRMED THEN

```

```

// Step 5: Automated Processing (Smart
Contract Logic)
RECEIVE funds
UPDATE amountRaised[selectedRequest] += donationAmount
ADD donorWalletAddress TO
contributors[selectedRequest]
IF amountRaised >= fundingGoal THEN
    SET requestStatus[selectedRequest] =
"FUNDED"
END IF
// Step 6: Confirmation
RECORD transaction ON blockchain
EMIT DonationReceived(donorWalletAddress,
selectedRequest, donationAmount)
ELSE
    RETURN "Transaction canceled by user"
END IF
// Step 7: End
RETURN "Donation successful"
END

```

5. Healthcare Record Management Interface

This interface guarantees the authenticity and integrity of all medical documents. Instead of storing large files on the blockchain, medical reports are stored in a decentralized file system (IPFS). The blockchain only stores a unique digital fingerprint (a hash) of that file. This ensures that if the original document is ever altered by even a single pixel, the fingerprint will no longer match, instantly revealing any tampering. Donors can use this to view the exact document the doctor originally uploaded. This module guarantees the authenticity and integrity of all medical documents.

Algorithm: Donor_Funding_Workflow

```

BEGIN
// Step 1: Start
Donor connects wallet to TOSS portal
// Step 2: View Needs
FETCH activeFundingRequests FROM
TOSSCore
DISPLAY requests TO donor

```

```

// Step 3: Initiate Donation
    Donor selects selectedRequest AND enters
    donationAmount
// Step 4: Execute Transaction
    CALL donate(selectedRequest, donationAmount)
    PROMPT donor to confirm transaction
    IF transaction CONFIRMED THEN
        // Step 5: Automated Processing (Smart
        Contract Logic)
            RECEIVE funds
            UPDATE amountRaised[selectedRequest] +=
            donationAmount
            ADD donorWalletAddress TO
            contributors[selectedRequest]
            IF amountRaised >= fundingGoal THEN
                SET requestStatus[selectedRequest] =
                "FUNDED"
            END IF
            // Step 6: Confirmation
            RECORD transaction ON blockchain
            EMIT DonationReceived(donorWalletAddress,
            selectedRequest, donationAmount)
        ELSE
            RETURN "Transaction canceled by user"
        END IF
        // Step 7: End
        RETURN "Donation successful"
    END

```

6. Donor Interaction Interface

This is the public-facing portal that provides complete transparency to donors. A donor connects their digital wallet, which serves as their secure login. The application reads data directly from the blockchain to display all live funding requests with real-time progress. For any request, the donor can click a "View Proof" button, which uses the file's fingerprint on the blockchain to retrieve and display the original, unaltered doctor's report. This is the public-facing portal that provides complete transparency to donors.

Algorithm: User_TOSSPortal_Workflow

BEGIN

```

// Step 1: Start
User visits TOSS website
// Step 2: Connect (Log In)
CONNECT wallet → userWalletAddress
AUTHENTICATE via blockchain (no password
required)
// Step 3: Fetch Live Data
CALL TOSSCore.getAllFundingRequests() →
fundingRequests
// Step 4: Display Information
DISPLAY fundingRequests WITH {childStory,
fundingGoal, progress}
// Step 5: Provide Proof
FOR each request IN fundingRequests DO
SHOW "View Proof" button
IF user clicks "View Proof" THEN CALL
HealthcareModule.verifyReport(request.reportCID)
DISPLAY doctor's original report FROM IPFS
END IF
END FOR
// Step 6: Enable Action
IF user clicks "Donate" THEN INITIATE
DonationModule.Donor_Funding_Workflow(reques
t)
END IF
// Step 7: End
RETURN "Session complete"
END

```

7. EXPERIMENTAL ANALYSIS

The implementation of the Transparent Orphanage Support System (TOSS) has shown that integrating blockchain, smart contracts, and decentralized storage can effectively overcome the limitations of existing orphanage support mechanisms by ensuring both financial transparency and healthcare record authenticity. Unlike traditional donation platforms that provide receipts without verifying the utilization of funds, TOSS immutably records every transaction on the blockchain and links it to specific welfare activities, allowing donors to verify in real time how their contributions are being used. The deployment of smart contracts further strengthens accountability by releasing funds only after requests are validated and supported by authenticated

documents, which are stored securely in IPFS. This prevents misuse of resources and builds donor confidence in the system. At the same time, children's healthcare records are digitally signed by doctors and stored in a tamper-proof format, ensuring that medical data remains accurate, verifiable, and resistant to manipulation. The donor dashboard enhances engagement by offering real-time insights into educational progress, nutrition, and health improvements, thereby providing a clear understanding of the impact created by donations. Testing also highlighted that the platform is reliable in processing transactions and storing records, although challenges such as gas fees on blockchain networks and the need for user training must be addressed for large-scale adoption. Overall, the results confirm that TOSS provides a more transparent, accountable, and trustworthy ecosystem compared to existing systems, and has the potential to become a scalable solution for NGOs, orphanages, and welfare institutions globally.

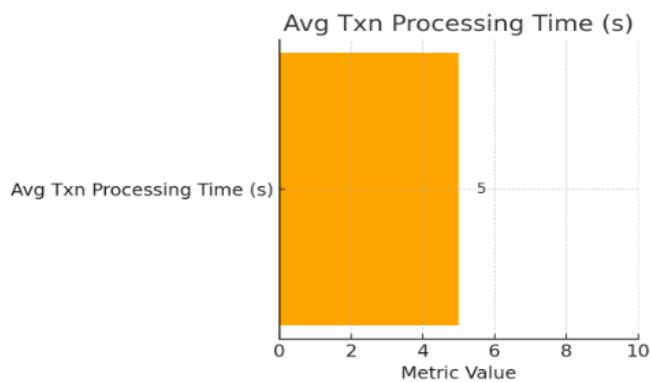


Fig 6. Average Transaction Processing Time Metric

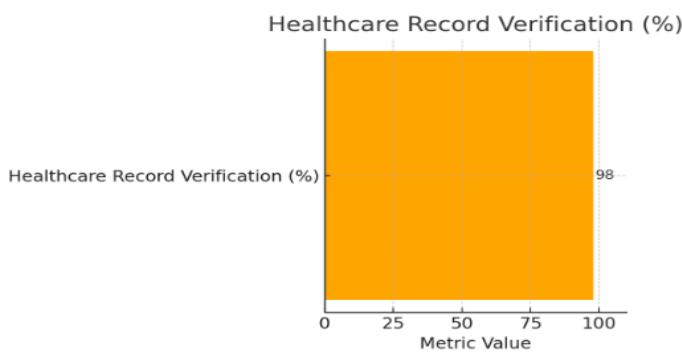


Fig 7. Healthcare Record Verification Metric

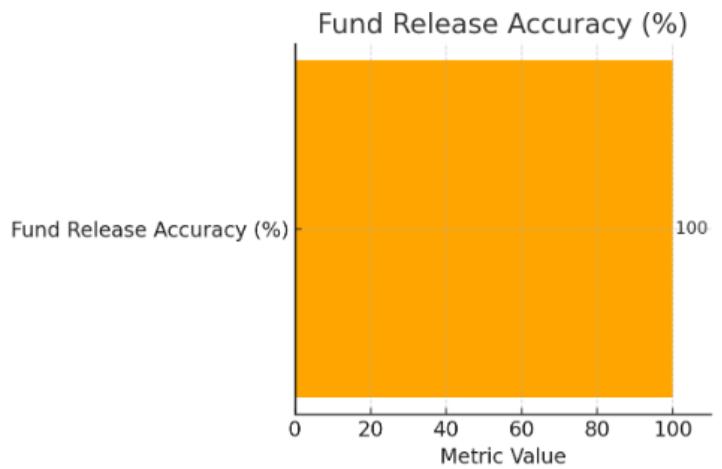


Fig 8. Fund Release Accuracy Metric

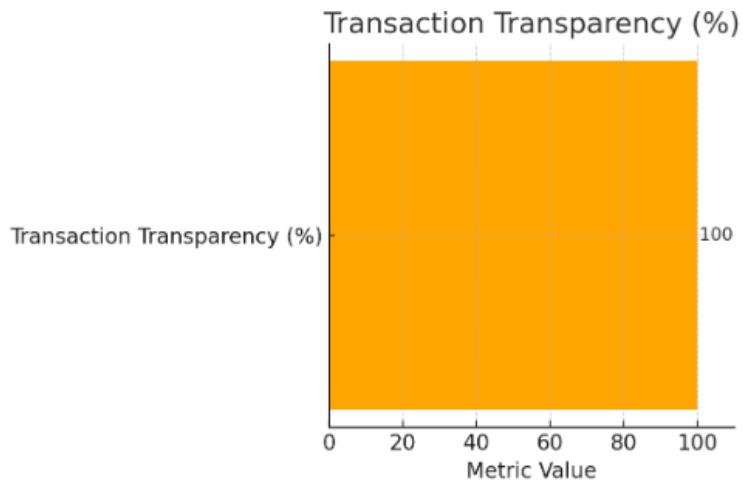


Fig 9. Transaction Transparency Metric

8. CONCLUSION

The Transparent Orphanage Support System (TOSS) is a pioneering initiative aimed at bringing trust, accountability, and transparency to the management of orphanage donations and child welfare. Traditional systems often struggle with issues such as lack of verifiable fund utilization, unreliable medical documentation, and limited donor engagement, which create doubts about the effective use of resources. TOSS overcomes these challenges by integrating blockchain for immutable record-keeping, smart contracts for automated and accountable fund allocation, and IPFS for secure and decentralized storage of medical records, thereby ensuring that funds and resources directly serve their intended purposes.

A key strength of TOSS lies in its donor-centric design, particularly through its interactive dashboard that allows contributors to track the real-time impact of their donations. This feature not only enhances donor confidence but also promotes long-term engagement with welfare institutions. At the same time, NGOs, doctors, and auditors gain access to authentic and tamper-proof data, streamlining monitoring and reporting processes while strengthening institutional credibility. The result is a more reliable and transparent ecosystem where all stakeholders are assured that every contribution is meaningfully utilized to improve the welfare of children.

While the system introduces a strong technological foundation, it also acknowledges practical challenges such as blockchain transaction costs, training requirements, and initial resistance to adoption. However, these can be mitigated through future enhancements and stakeholder education. Beyond orphanages, the scalability of TOSS makes it a versatile model for welfare management that can be extended to schools, hospitals, and global aid organizations. Ultimately, TOSS is not just a technological solution but a transformative approach to sustainable and ethical welfare governance, setting new standards for transparency in social support systems.

9. FUTURE ENHANCEMENT

Future use and development of the Transparent Orphanage Support System (TOSS) will focus on expanding its reach and enhancing usability for all stakeholders. While the current system ensures transparency and accountability in orphanage donations, it serves as a foundation for broader applications. One future direction is to extend TOSS to schools, hospitals, and global welfare organizations, creating a unified ecosystem for ethical resource management. Another important advancement would be the integration of AI-driven health monitoring and predictive analytics, enabling proactive healthcare support for children. To make the system more accessible, features like

multi-language support and cross-border donations will be introduced, encouraging global participation. Over time, user feedback and adoption insights will drive continuous refinement, ensuring that TOSS evolves into a scalable and sustainable welfare platform capable of addressing diverse social support needs.

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