

Project Report: Decentralized Secure Event Ticketing Platform

Date: December 15, 2025 Author: Cihan Aygün - 211401010

1. Introduction

This project implements a **Decentralized Event Ticketing Platform (DApp)** that addresses common issues in the traditional ticketing industry, such as scalping, lack of transparency, and inefficient refund processes. By leveraging **blockchain technology**, specifically the Ethereum network (simulated via Hardhat), we create a secure, transparent, and user-centric ticketing ecosystem.

Key features include:

- **NFT-Based Tickets:** Each ticket is a unique ERC-721 token.
- **Transparent Resale:** Refunded tickets are returned to the pool for resale at face value, preventing price manipulation.
- **Organizer Controls:** Event creators can scan tickets and manage event lifecycles.
- **Community Voting:** Attendees can vote on completed events, creating a reputation system for organizers.

2. System Architecture

The application follows a modern DApp architecture:

- **Smart Contracts (Backend):** Written in **Solidity**, deployed on a local Hardhat Network.
- **Frontend:** Built with **Next.js (React)**, using **Tailwind CSS** for styling.
- **Blockchain Interaction:** **Wagmi** and **Viem** hooks are used to connect the frontend to the smart contracts.
- **Wallet Integration:** **RainbowKit** handles wallet connections (e.g., MetaMask).

Technological Stack

- **Solidity 0.8.20:** Safe and efficient smart contract language.
- **OpenZeppelin:** Standard libraries for ERC-721 and Ownable patterns.
- **Hardhat:** Development environment for compiling, testing, and deploying contracts.
- **TypeScript:** Ensures type safety across the full stack.

3. Smart Contract Implementation

The core logic is divided into two main contracts: `TicketingFactory` and `TicketingContract`.

3.1. Factory Pattern (`TicketingFactory.sol`)

To allow any user to create an event, we use a Factory pattern. This contract deploys a new instance of `TicketingContract` for each event, ensuring isolation and scalability.

Code Snippet: Creating an Event

```
● ● ●

function createEvent(
    string memory _name,
    string memory _description,
    uint256 _maxSupply,
    uint256 _ticketPrice,
    uint256 _eventStartDate,
    uint256 _entryDuration
) external returns (address) {
    // Deploy new contract
    TicketingContract newEvent = new TicketingContract(
        msg.sender, // Initial Owner
        _name,
        _description,
        _maxSupply,
        _ticketPrice,
        _eventStartDate,
        _entryDuration
    );

    address eventAddr = address(newEvent);
    allEvents.push(eventAddr);
    organizerEvents[msg.sender].push(eventAddr);

    emit EventCreated(eventAddr, msg.sender, _name);

    return eventAddr;
}
```

3.2. Ticket Logic (`TicketingContract.sol`)

This contract manages the lifecycle of tickets for a specific event.

Minting & Resale Logic

A critical innovation in this project is the **Refund/Resale Mechanism**. Instead of permanently burning refunded tickets, they are returned to the contract. When a new user tries to buy a ticket, the contract prioritizes selling these "refunded" tickets first.

Code Snippet: Minting with Priority Resale

```
● ● ●

function mintTicket() external payable nonReentrant returns (uint256 tokenId) {
    if (msg.value != TICKET_PRICE) revert("Incorrect Value");

    // Check Resale Queue (Refunded Tickets)
    if (refundedTicketIds.length > 0) {
        // Pop from stack
        tokenId = refundedTicketIds[refundedTicketIds.length - 1];
        refundedTicketIds.pop();

        // Critical Fix: Use _transfer to bypass approval checks since Contract is owner
        _transfer(address(this), msg.sender, tokenId);

        tickets[tokenId].status = STATUS_ACTIVE;
        stats.totalSold++;
    } else {
        // Standard Minting
        if (stats.totalMinted >= MAX_SUPPLY) revert SupplyExhausted();
        stats.totalMinted++;
        tokenId = stats.totalMinted;

        _safeMint(msg.sender, tokenId);
        tickets[tokenId].status = STATUS_ACTIVE;
        stats.totalSold++;
    }
}
```

Refund Mechanism

Users can request a refund up to 6 hours before the event. The ticket is transferred back to the contract, and the user is refunded.

Code Snippet: Refund Logic

```
function requestRefund(uint256 tokenId) external nonReentrant {
    if (block.timestamp >= refundDeadline) revert RefundPeriodExpired(block.timestamp, refundDeadline);

    // Transfer ticket to contract
    transferFrom(msg.sender, address(this), tokenId);

    // Update State: Mark as FOR_SALE
    tickets[tokenId].status = STATUS_FOR_SALE;
    refundedTicketIds.push(tokenId);
    stats.totalSold--;

    // Refund Money
    payable(msg.sender).transfer(TICKET_PRICE);
}
```

Voting Mechanism

Users can request a refund up to 6 hours before the event. The ticket is transferred back to the contract, and the user is refunded.

Code Snippet: Voting Logic

```
function vote(uint256 tokenId, bool isPositive) external {
    if (block.timestamp > votingDeadline) revert VotingPeriodExpired(block.timestamp, votingDeadline);
    // Can only vote if they attended (scanned -> BURNED)
    if (tickets[tokenId].status != STATUS_BURNED) revert VoteEligibilityFailed(tokenId);
    if (tickets[tokenId].hasVoted) revert AlreadyVoted(tokenId);

    tickets[tokenId].hasVoted = true;
    stats.totalVoted++;
    if (isPositive) {
        stats.positiveVotes++;
    }
}
```

4. Frontend Implementation

The frontend provides a user-friendly interface for interacting with the blockchain.

4.1. Creating an Organization

Users can easily deploy their own event contracts by filling out a form.

Create Organization / New Event

9,999.9 ETH 0x70...79C8 ▾

Organization / Event Name
e.g. Summer Music Festival

Description
Event details...

Total Ticket Supply
100

Ticket Price (ETH)
0.01

Event Start Date
mm/dd/yyyy --:-- --

Entry Deadline (Hours from Start)
e.g. 24

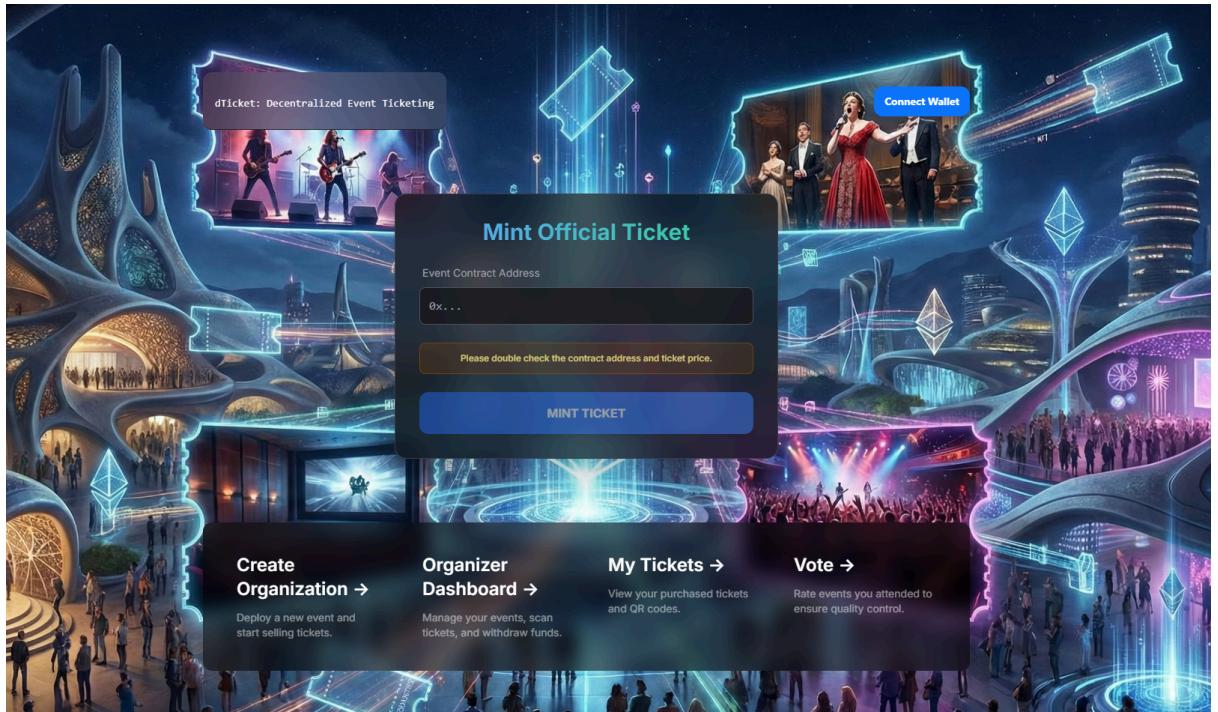
Check-ins allowed until: Start Date + 0h

Create Organization & Event

Platform Rules
Click here to view the Decentralized Ticket App Rules and Smart Contract Logic.

4.2. Ticket Purchase

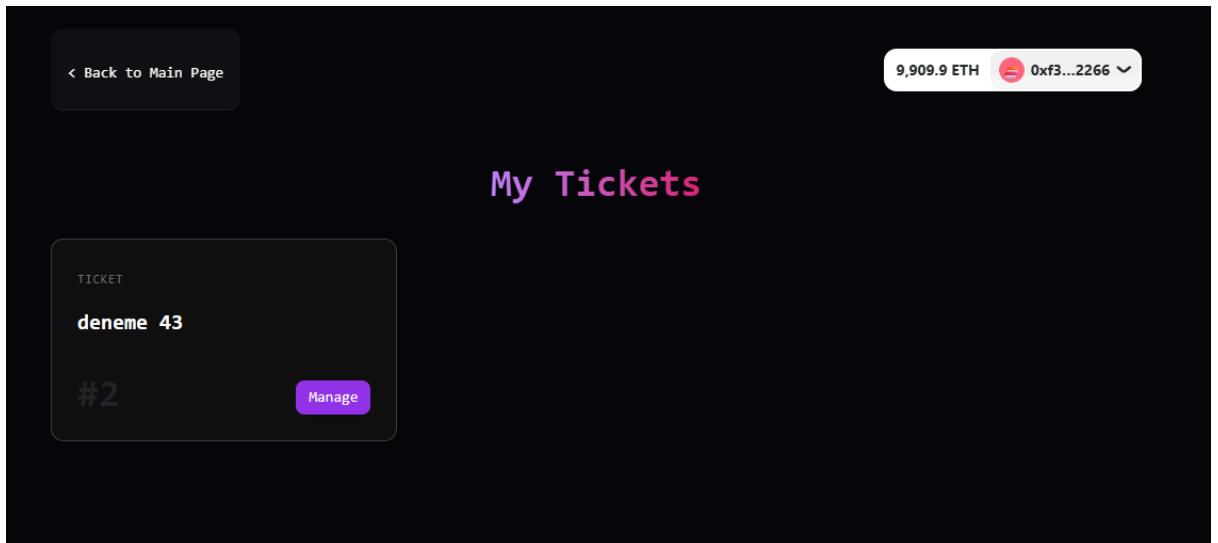
The main landing page allows users to find events and mint tickets. The UI handles wallet connection and transaction feedback.

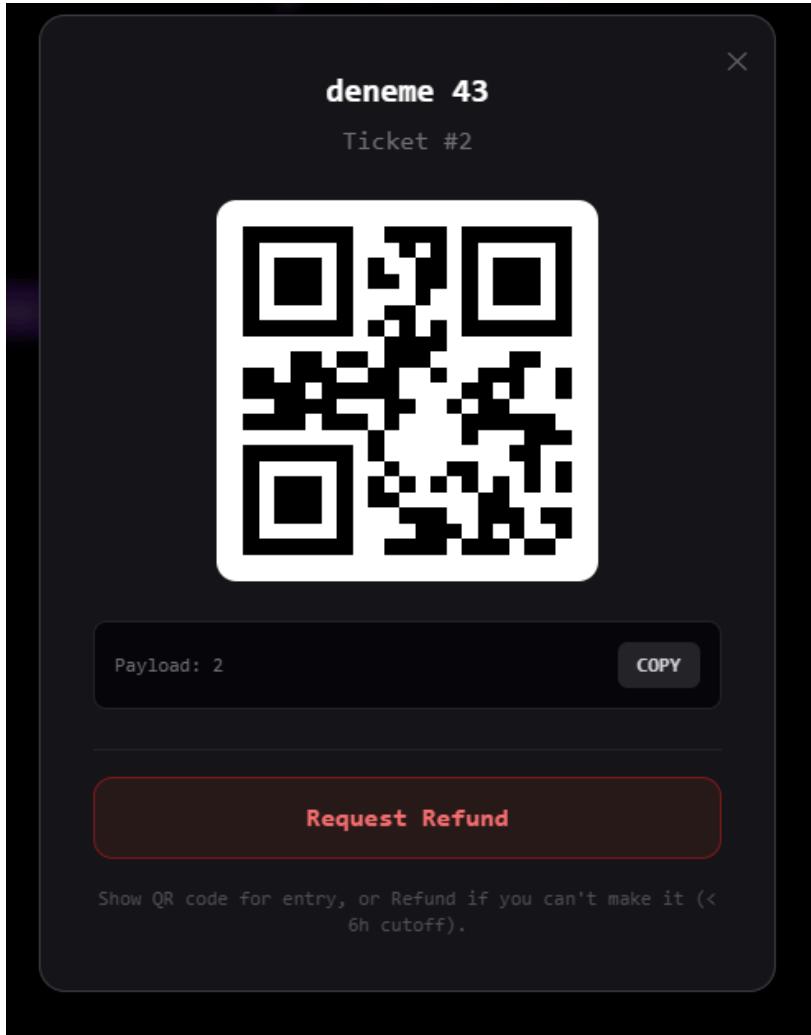


4.3. My Tickets & Refunds

The "My Tickets" page displays the user's tickets. It allows users to:

- Reveal QR Code:** Generates a cryptographic signature (off-chain) for entry validation.
- Request Refund:** Returns the ticket to the pool.





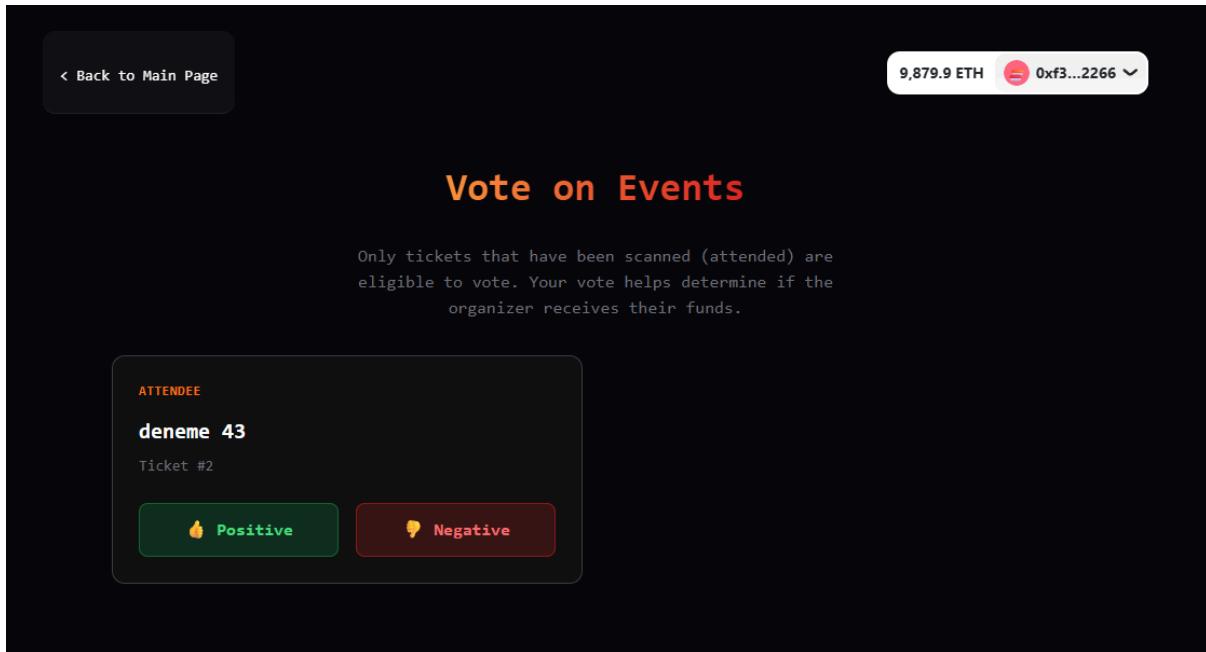
4.4. Organizer Dashboard

Organizers can view their events and use the **Gatekeeper** feature to scan QR codes. This validates attendance on-chain.

A screenshot of the organizer dashboard. It shows a header with "Organizer Dashboard" and a balance of "9,909.9 ETH" with a copy/paste icon. On the left, a section titled "Your Events" shows an event titled "deneme 43" with details: "deneme 43", "Start: 12/20/2025, 1:01:00 AM", and a QR code hash "0x856e4424f806d16e8cbc702b3c0f2ede5468eae5". On the right, a "Check-In / Ticket Scan" section has a "Target Contract" field with the value "0x856e4424f806d16e8cbc702b3c0f2ede5468eae5". It includes a "Simulate QR Code Scan (Enter QR Payload)" input field, a "QR Payload..." button, and a purple "SCAN" button.

4.5. Voting Page

After an event, attendees with scanned tickets can access the Voting Page to cast a positive or negative vote. This feedback helps future attendees evaluate organizer quality.



5. Challenges and Solutions

Challenge: Reselling Refunded Tickets

Problem: Initially, when a refunded ticket (owned by the contract) was being sold to a new user, the transaction failed with an "Unauthorized" error. This happened because the standard `transferFrom` function requires the sender (`msg.sender`) to be approved, but in this case, the *contract itself* is the owner and initiator.

Solution: We modified the smart contract to use the internal `_transfer` function (from OpenZeppelin's `ERC721`) instead of `transferFrom` within the `mintTicket` function. This allows the contract to securely transfer its own tokens to the buyer without needing an external approval transaction.

Challenge: Frontend Configuration

Problem: Every time the contracts were redeployed, the contract address changed, breaking the frontend until manually updated.

Solution: We implemented an automated deployment script. Now, `deploy.ts` writes the new contract address directly to a shared TypeScript configuration file (`frontend/utils/contractAddress.ts`), ensuring the frontend is always in sync.

6. Conclusion

This project successfully demonstrates a functional decentralized ticketing system. It solves key industry problems through transparent resale mechanisms and secure ownership verification. The combination of a robust Solidity backend and a reactive Next.js frontend provides a seamless user experience comparable to Web2 applications.