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pragma solidity ^0.8.0;

contract Election {

address public admin;

bool public electionEnded;

uint256 public totalVotes;

// Mapping from hashed fingerprint ID (DID) to voting status

mapping(bytes32 => bool) public hasVoted;

// Mapping from candidate ID to vote count (stored as string hash for DID linkage)

mapping(uint256 => string) public voteCounts;

// Candidate list (for example: 1, 2, 3, 4)

uint256[] public candidates;

// Events for vote casting and election end

event VoteCast(bytes32 indexed voterDID, uint256 candidate, string voteCountHash);

event ElectionEnded(uint256[] results, uint256 winner);

constructor(uint256[] memory candidateIds) {

admin = msg.sender;

candidates = candidateIds;

electionEnded = false;

}

// Function for a voter to cast their vote.

// voterDID is the keccak256 hash of the unique fingerprint ID.

// voteData is a string representing the new vote count (after increment) that is hashed.

function vote(bytes32 voterDID, uint256 candidate, string memory voteData) public {

require(!electionEnded, "Election has ended");

require(!hasVoted[voterDID], "This voter has already cast a vote");

require(validCandidate(candidate), "Invalid candidate");

hasVoted[voterDID] = true;

// Update vote count stored as a string hash for transparency

voteCounts[candidate] = voteData;

totalVotes += 1;

emit VoteCast(voterDID, candidate, voteData);

}

// Function to end the election (only callable by admin)

function endElection() public {

require(msg.sender == admin, "Only admin can end the election");

electionEnded = true;

uint256 winningCandidate = candidates[0];

string memory highestVoteData = voteCounts[winningCandidate];

// The winner determination logic would compare numerical vote counts

// For this simplified example, we assume highestVoteData corresponds to highest votes.

// In a full implementation, you would decode and compare the actual vote counts.

uint256[] memory results = new uint256[](candidates.length);

for (uint i = 0; i < candidates.length; i++) {

// In a complete contract, results[i] would be decoded from voteCounts[candidates[i]]

results[i] = 0; // Placeholder

}

emit ElectionEnded(results, winningCandidate);

}

function validCandidate(uint256 candidate) internal view returns (bool) {

for (uint i = 0; i < candidates.length; i++) {

if (candidates[i] == candidate) {

return true;

}

}

return false;

}

// Function to get all candidate results (for UI)

function getAllResults() public view returns (string[] memory) {

string[] memory results = new string[](candidates.length);

for (uint i = 0; i < candidates.length; i++) {

results[i] = voteCounts[candidates[i]];

}

return results;

}

}

**Explanation**

**Decentralized Identity (DID):** Each voter’s fingerprint ID is hashed off-chain using keccak256. This hash serves as the voter's DID on the blockchain.

**Vote Recording:** When a vote is cast, the smart contract records the vote by updating the vote count for the candidate. The vote count is stored as a string which is then hashed to link with the DID.

**Immutable Audit Trail:** Every vote transaction is permanently recorded on the blockchain, ensuring transparency and enabling public audits.

**Smart Contract Enforcement:** The contract enforces that each DID can vote only once and handles the end-of-election process to declare the winner.