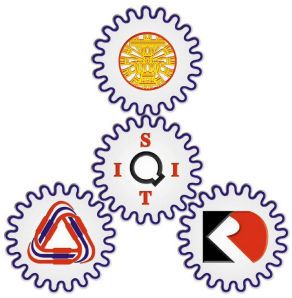

Capstone Project

Ballon d'Or Voting System Using Blockchain

Presented by

Diyorbek Bakhtiyor Ugli Okyulov	6322770239
Ekpiti Kawtummachai	6322770387
Pansan Ruangphaisan	6322771773
Thanakrit Suphasiriroj	6322773258
Poomrapee Tippayamontri	6322773969

Presented to

Lecturer: Dr. Watthanasak Jeamwatthanachai

Blockchain Development – CSS486

Sirindhorn International Institute of Technology Thammasat University

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Chapter 1

Introduction

Problem Statement

Traditional voting systems for prestigious awards like the Ballon d'Or in football often face challenges related to transparency, security, and authenticity. The current methods, relying on centralized authorities, are susceptible to manipulation, fraud, and lack of trust. Fans and stakeholders are often left in the dark regarding the integrity of the voting process, leading to controversies and doubts about the fairness of the results. In addition, the lack of a decentralized and tamper-resistant system opens the door for biased practices, potentially compromising the credibility of the award.

Objectives

1. Implement a Decentralized Voting System
2. Enhance Transparency and Trust
3. Ensure Security and Integrity

Stakeholder Benefits

Increased Transparency and Trust

Stakeholders, including football fans, players, and the football community at large, will benefit from increased transparency in the Ballon d'Or voting process. The use of blockchain ensures that every vote is recorded in a tamper-resistant manner, providing an immutable and publicly accessible ledger. This transparency fosters trust among stakeholders, as they can independently verify the authenticity of the voting results, ultimately enhancing the credibility of the award.

Enhanced Security and Fairness

Stakeholders will experience heightened security in the voting process, as the blockchain technology employed ensures that the system is resistant to hacking, fraud, and manipulation. By implementing robust cryptographic techniques and decentralized consensus mechanisms, the integrity of the voting system is preserved, reducing the risk of biased practices or external

interference. This heightened security contributes to a fair and unbiased selection of the Ballon d'Or winner, providing stakeholders with confidence in the legitimacy of the outcome.

Global Inclusivity and Engagement

The proposed blockchain-based voting system opens up participation to a global audience of football enthusiasts. Fans from around the world can actively engage in the voting process, breaking down geographical barriers and ensuring that the Ballon d'Or reflects the diverse opinions and preferences of the international football community. This inclusivity not only broadens the reach of the award but also creates a more vibrant and engaged community of stakeholders who feel a direct connection to the voting process and the ultimate

Chapter 2

Related Documents and Literatures

Literatures:

Blockchain

A blockchain is a distributed and decentralized digital ledger technology that enables secure and transparent record-keeping of transactions across a network of computers. It consists of a chain of blocks, each containing a list of transactions, and is designed to be resistant to modification or tampering. The fundamental features of a blockchain contribute to its reliability and trustworthiness in various applications, including cryptocurrency, supply chain management, voting systems, and more.

Decentralization

A blockchain operates on a network of computers (nodes) that are distributed across different locations. Each node has a copy of the entire blockchain, and there is no central authority governing the system. This decentralization eliminates the need for a single controlling entity and enhances the system's resilience and security.

Consensus Mechanism

Blockchain networks rely on consensus mechanisms to agree on the state of the ledger. Common consensus methods include Proof of Work (used in Bitcoin) and Proof of Stake. These mechanisms ensure that all nodes in the network reach a consensus on the validity of transactions and the order in which they are added to the blockchain.

Smart Contracts

Smart contracts are self-executing contracts with the terms of the agreement directly written into code. They automatically execute and enforce the terms of an agreement when predefined conditions are met. Smart contracts can be deployed on certain blockchain platforms, adding programmable and automated functionalities to the network.

Ganache

Ganache is a personal blockchain emulator that is commonly used in Ethereum development. It is part of the Truffle suite, a set of development tools for Ethereum. Ganache provides a local blockchain environment that developers can use for testing,

deploying, and debugging their Ethereum-based applications without interacting with the main Ethereum network.

Solidity

Solidity is a programming language specifically designed for developing smart contracts on blockchain platforms, with a primary focus on the Ethereum blockchain. Smart contracts are self-executing contracts with the terms directly written into code. These contracts run on the Ethereum Virtual Machine (EVM), and Solidity is the language used to write the code for these contracts.

HTML

Stands for HyperText Markup Language, is the standard markup language used to create and structure content on the World Wide Web. It forms the backbone of web pages and web applications, providing a standardized way to present information and create a hierarchical structure for content

CSS

Which stands for Cascading Style Sheets, is a style sheet language used to describe the presentation and formatting of a document written in HTML or XML. CSS enables web developers to control the layout, appearance, and style of multiple web pages consistently. By separating the content (HTML) from the presentation (CSS), developers can achieve a cleaner and more maintainable code structure.

Related Documents:

The City of Moscow's Blockchain Voting System

In 2019, the City of Moscow tested a blockchain-based voting system for its local government elections. The system aimed to enhance transparency and reduce the risk of fraud in the voting process.

Voatz

Voatz is a mobile voting platform that utilizes blockchain technology to enable secure and transparent voting. It has been used in various elections, including municipal and state elections in the United States. Voatz incorporates identity verification and cryptographic techniques to ensure the integrity of the voting process.

Chapter 3

Develop The Smart Contract

The main code for the backend is written in the Election.sol folder. In this section we will be mainly explaining the code we have written what does each code does and what is it used for.

```
// SPDX-License-Identifier: MIT
```

This line specifies the license under which the smart contract code is released. In this case, it's the MIT License.

```
pragma solidity >=0.5.0 <0.9.0;
```

This line specifies the version of the Solidity compiler that should be used to compile the contract. The contract is designed to work with Solidity versions greater than or equal to 0.5.0 and less than 0.9.0.

```
contract Election{
```

This line declares the start of the "Election" contract.

```
address public manager;
```

Declares a state variable manager of type address and marks it as public, meaning it can be accessed outside the contract. It will store the address of the contract manager.

```
struct Candidate {
    uint id;
    string CfirstName;
    string ClastName;
    string CidNumber;
    uint voteCount;
}
```

Defines a structure Candidate to represent information about a candidate in the election. It includes fields for id, CfirstName, ClastName, CidNumber, and voteCount.

```
mapping (address => bool) public voters;
```

Declares a mapping named voters that maps addresses to boolean values. It is used to keep track of whether an address has voted in the election.

```
mapping (uint => Candidate) public candidates;
```

Declares a mapping named candidates that maps candidate IDs to Candidate structures. It is used to store information about each candidate in the election.

```
uint public candidatesCount;
```

Declares a public variable candidatesCount of type uint to keep track of the total number of candidates in the election.

```
event votedEvent (
    uint indexed_candidateId
);
```

Declares an event named votedEvent that will be emitted when a user votes. It includes the candidate ID as an indexed parameter.

```
constructor () public  {
    manager = msg.sender;
}
```

Constructor function that initializes the manager variable with the address of the account deploying the contract.

```
function addCandidate (string memory _CfirstName, string memory _ClastName, string memory _CidNumber) public onlyAdmin{
    candidatesCount++;
    candidates[candidatesCount] = Candidate(candidatesCount, _CfirstName, _ClastName, _CidNumber, 0);
}
```

Function to add a new candidate to the election. It increments the candidatesCount, creates a new Candidate struct, and stores it in the candidates mapping.

```
modifier onlyAdmin () {
    require(msg.sender == manager);
    _;
}
```

Modifier onlyAdmin that restricts access to certain functions (like addCandidate) to the contract manager.

```
function vote (uint _candidateId) public {

    require(!voters[msg.sender]);

    require(_candidateId > 0 && _candidateId <= candidatesCount);

    voters[msg.sender] = true;

    candidates[_candidateId].voteCount ++;

    uint candidateId = _candidateId;

    emit votedEvent(_candidateId);
}
```

Function allowing a user to vote for a candidate. It checks if the sender hasn't voted before, the candidate ID is valid, marks the sender as voted, increments the candidate's vote count, emits the votedEvent event.

```
//users
//register
struct User {
    string firstName;
    string lastName;
    string idNumber;
    string email;
    string password;
    address add;
}
```

Defines a structure User to represent information about a user. It includes fields for firstName, lastName, idNumber, email, password, and add (address).

```
mapping (uint => User) public users;
```

Declares a mapping named users that maps user IDs to User structures. It is used to store information about each registered user.

```
uint public usersCount;
```

Declares a public variable usersCount of type uint to keep track of the total number of registered users.

```
function addUser (string memory _firstName, string memory _lastName, string memory _idNumber, string memory _email, string memory _password) public{
    usersCount++;
    users[usersCount] = User(_firstName, _lastName, _idNumber, _email, _password, msg.sender);
}
```

Function to register a new user. It increments the usersCount, creates a new User struct, and stores it in the users mapping.

```
var Election = artifacts.require("./Election.sol");

module.exports = function(deployer) {
    deployer.deploy(Election);
};
```

The purpose of this migration script is to deploy the Election smart contract to the Ethereum blockchain.

Chapter 4

Design and Implementation

We have designed and implemented a secure and transparent blockchain-based voting system for the Ballon d'Or football award. This system aims to revolutionize the traditional voting process by leveraging the capabilities of blockchain technology, ensuring fairness, transparency, and integrity. We have 2 roles in this project: voter and admin.

Voter Role

User Registration:

- Voters are required to register for the system by providing necessary details and completing the registration process. A registration fee is set to ensure the authenticity of voters.

Single Vote Per User:

- Each registered user is allowed one vote only. This restriction ensures a fair and equal opportunity for all voters to express their choice for the Ballon d'Or winner.

Candidate Selection:

- Voters can view the list of candidates for the Ballon d'Or and make their selection through a user-friendly interface. The blockchain ensures the immutability and transparency of the voting transactions.

Viewing Results:

- After casting their vote, users can access real-time updates on the voting results. The transparency of the blockchain allows users to independently verify the accuracy and authenticity of the results.

Admin Role

Adding Candidates:

- Admins have the authority to add new candidates to the list. This includes updating information about players, adding their achievements, and providing relevant details for voters to make informed decisions.

Managing Candidate Data:

- Admins can update and maintain the database of candidates, ensuring that the information presented to voters is accurate and up-to-date.

Prototyping

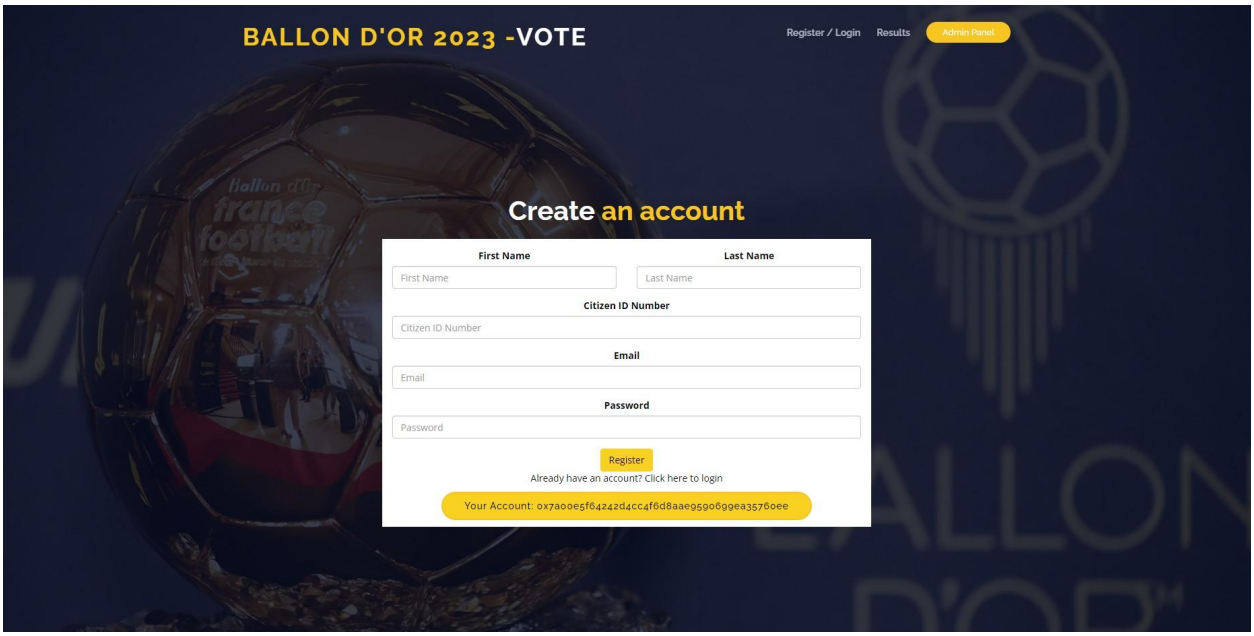

Figure 1

The user can first create an account by filling out all the information. 1 user can only create 1 account.

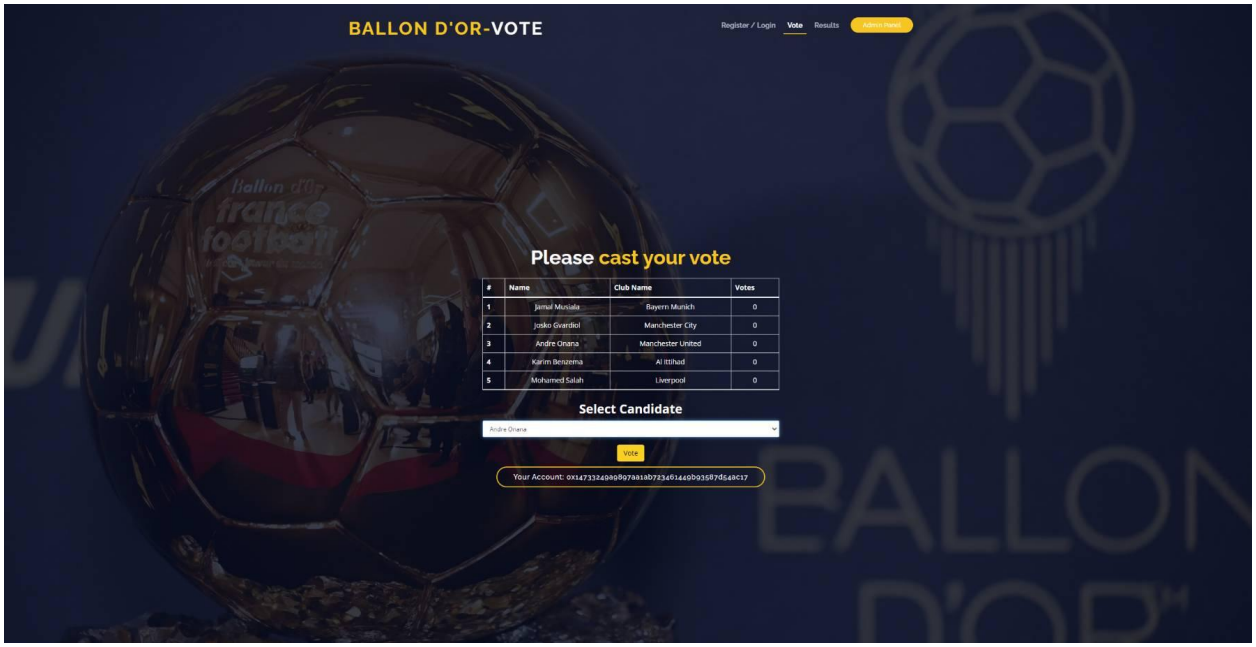

Figure 2

After creating the account the voter can vote for the football player. In this layout the voter can see the names, club names and number of votes.

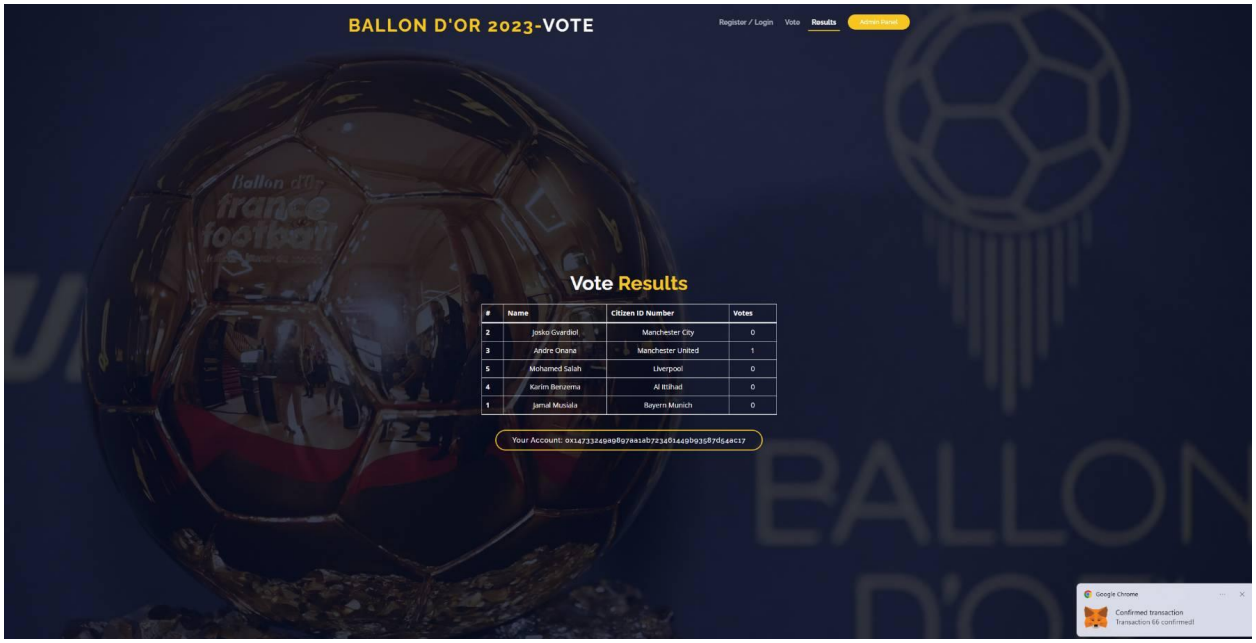

Figure 3
The voter can see the vote result after voting

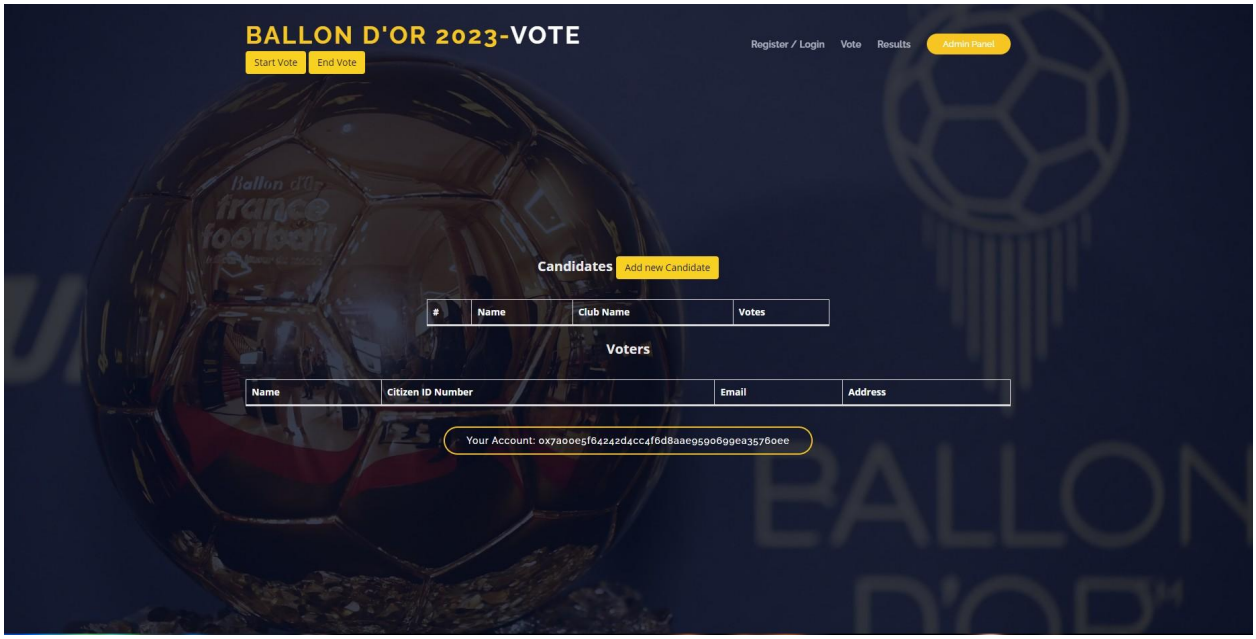

Figure 4
The admin can start and end the vote. The admin is also able to add new candidates and see the voters information.

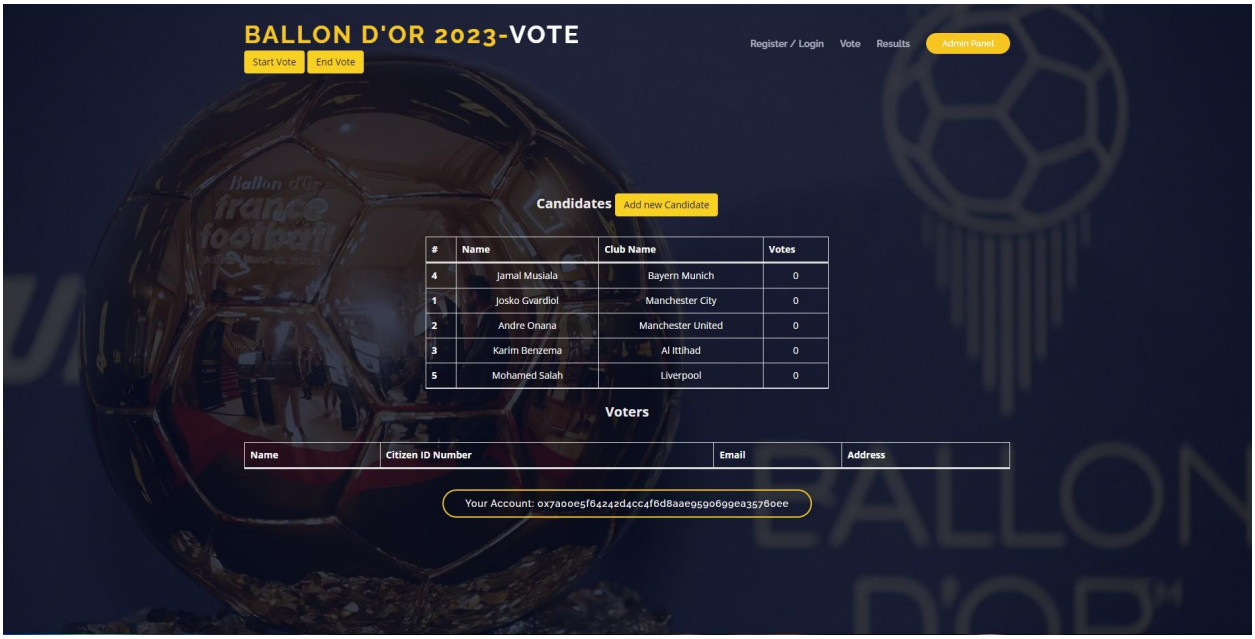

Figure 5
Example of candidates for the Ballon d'Or names are inserted.

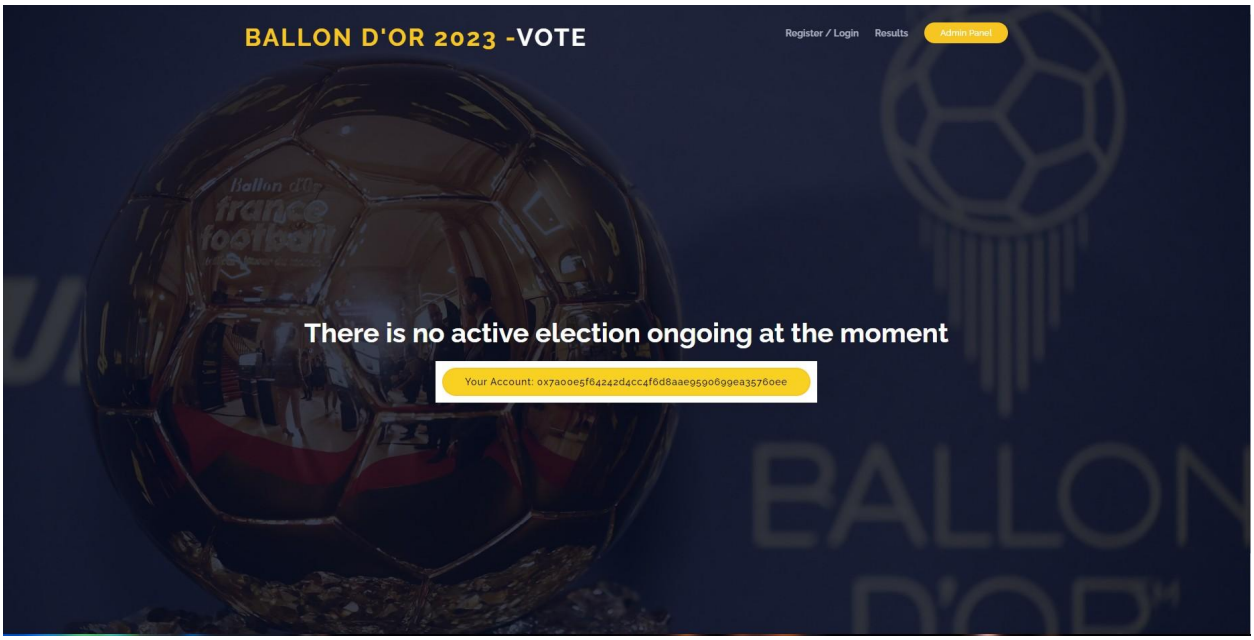

Figure 6
If there is no active election yet. This page will be shown.

Chapter 5

Conclusion

Conclusion

In conclusion, the development of a blockchain-based voting system for the Ballon d'Or represents a pioneering effort to address the shortcomings of traditional voting processes. By harnessing the decentralized and transparent nature of blockchain technology, our project aims to instill a new level of trust and fairness in the selection of the football award winner. The system, designed to allow registered users a single, secure vote while protecting their privacy, and administered by a transparent and accountable admin role, aspires to revolutionize the voting experience. With the successful integration of smart contracts, cryptographic techniques, and a user-friendly interface, this project not only offers a credible solution to the challenges posed by conventional voting but also sets a precedent for the application of blockchain in enhancing the integrity and inclusivity of renowned sports awards.

Obtained Benefits

1) **Enhanced Transparency:**
   Stakeholders can independently verify and audit the voting process, leading to increased transparency in the selection of the Ballon d'Or winner.
2) **Improved Credibility:**
   The transparent nature of the blockchain-based system contributes to heightened trust and credibility in the award selection, addressing concerns associated with traditional voting methods.
3) **Security Against Manipulation:**
   Utilization of cryptographic techniques ensures the security of the voting process, protecting against manipulation and biased practices that may compromise the fairness of the award.
4) **Global Inclusivity:**
   The decentralized nature of the system enables football enthusiasts worldwide to actively participate in the voting process, breaking down geographical barriers and fostering a more inclusive and engaged international community.
5) **Protecting Voter Privacy:**
   The blockchain system incorporates privacy features to safeguard the anonymity of voters, ensuring a balance between transparency and individual confidentiality.
6) **Transformative Solution:**
   The successful integration of smart contracts, cryptographic techniques, and a user-friendly interface positions the blockchain-based voting system as a

transformative solution to challenges in conventional voting, setting a precedent for enhancing the integrity and inclusivity of renowned sports awards.