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Smart Voting System Using IoT with Biometric (Face and Fingerprint Recognition)

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Abstract: *This project is about an online voting system using face and fingerprint recognition. The main aim of this project is to make voting secure and easy. In normal voting system many problems are there like fake voting and same person voting many times. So to reduce this problem, we are using face and fingerprint recognition method in our project.*

In this system, first voter has to register by filling details and face image. When voter wants to vote, camera gets on and face image is taken. The system detects face using Haar Cascade method. After face detection, the system uses LBPH technique to read the face details. This face is compared with the face data which is already stored in database.

If both face data matches, then voter is allowed to give vote. After giving vote one time, voter cannot vote again. If face is not matching, then voting is not allowed and message is displayed on screen. By this way fake voting is avoided.

All voter details and voting information is saved safely in the system. Because the process is automatic, it saves time and manual work is less. This project gives a simple solution for online voting using face and fingerprint recognition..

Keywords: Online Voting System, Face Recognition, Fingerprint Recognition, Secure Voting, Fake Voting Prevention, Voter Registration, Face Detection, Database

I. INTRODUCTION

Today it is important to have a safe voting system. When we use the ways of voting we see a lot of problems. For example people might vote falsely. There might be mistakes when votes are counted by hand. Sometimes people have to wait in line for a time to vote. It takes a long time to count all the votes and get the results. That is why we need a voting system, a voting system that is smart and safe a voting system that is, like the new voting system. The new voting system should be able to solve these problems and make voting easier and faster. We need a voting system that's safe and reliable a voting system that is good.

The Internet of Things helps connect the voting machines to a system. This way the Smart Voting System can keep track of voting data. Store it as it happens. The Smart Voting System makes sure the voting process is safe and easy to use.

When you go to vote they check who you are in two ways. They use face recognition to see if your face matches the picture they have of you. Then they use your fingerprints to make sure it is really you. This way they can be sure that only you can vote and it helps stop people from voting when they are not supposed to or voting more, than once.

This system also allows election officials to monitor the process remotely and declare results quickly and accurately. Overall, the smart voting system improves security in elections.

II. PROBLEM STATEMENT

The old voting process has many problems that affect how elections are carried out. People often have to stand in long lines and wait for a long time to give their vote. The use of paper votes and hand checking makes the process slow and

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tiring for both voters and staff. This also increases the chances of mistakes while voting and counting votes. Because of these problems, the whole voting experience becomes difficult and less trustworthy.Another serious problem is the risk of wrong or fake

voting. In hand-based voting systems, a wrong person may try to vote, or the same person may vote more than one time. Checking voters by hand is not always correct, especially when there are many voters. This can cause confusion and make people trust the election results less

The voting process also limits participation for some people. People who live far, not feeling well, or have personal problems may not be able to go to the voting place. This stops them from voting and makes voting less fair.

Because of these problems, it is a need of this type of voting system that is simple, safe, and easy. A Smart Voting System using IoT can help by making voting faster, stopping mistakes, and stopping wrong voting. It also makes the voting process easy for everyone.

III. OBJECTIVES OF THE PROJECT

- This project focuses on creating a smart and secure voting system using IoT technology.
- In this system, voting is allowed only after face recognition and fingerprint verification, so only the voter who are eligible to vote and the real voter can vote.
- Because each person has a different face and fingerprint, this system helps us to stop fake voting and repeated voting.
- The whole voting process works automatically, which reduces human work and avoids mistakes. Since votes are stored digitally, the system becomes more transparent and trustworthy.
- Using IoT, the voting data can be sent and checked in real time, which makes the system more reliable. This system also saves a lot of time and help to reduce long lines at voting centers.
- The voter's information are kept secure and also voting data are kept secure, so privacy is maintained.

IV. SYSTEM OVERVIEW

System using IoT with Biometric Authentication is designed to provide a secure and reliable voting process. The system uses fingerprint recognition and face recognition to verify the identity of voters before allowing them to vote. Since biometric details are unique for every person, the system helps in preventing fake and duplicate voting.

A. COMPONENT WISE DESCRIPTION

1. Main Electronic Controller (Microcontroller and Embedded System)

The central control unit is the core of the smart voting system. It manages all system operations, including biometric verification, vote validation, and communication with the IoT module. The controller processes input data received from the fingerprint sensor and camera and compares it with the stored database records. Based on the authentication result, it allows voting access. The controller ensures that once a vote is cast, the voter cannot vote again.

2. Fingerprint Sensor

The fingerprint is used to capture voter's fingerprint during authentication. Each voter has a unique fingerprint. During voter registration, fingerprint data is stored in the database. On voting day, the live fingerprint is scanned and matched with the stored data. If the match is successful, the system proceeds to face recognition for further verification.

3. Camera Module (Face Recognition Unit)

The camera module captures the face image of the voter in real time. Face recognition technique verifies the captured image with the Recorded facial data stored in the database.

4. IoT Communication Module

The IoT module is responsible for communicating voting data securely to the central server. Once a vote is cast, the data is encrypted and sent to the internet. This enables real-time monitoring of voting activity and ensures transparency.

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5. Database Server

The database server stores voter biometric data, voting status, and vote records. It ensures data. It keeps the data safe and ensures that only authorized people can access it. Once a voter gives their vote, the database updates the voter status to block any further voting attempts.

6. Voting Interface (Display / Input Unit)

The voting interface allows the authenticated voter select a candidate. It is designed to be simple and user-friendly so all age groups of voters can use it easily. Once the vote is submitted, the interface confirms successful voting.

B. THE SYSTEM'S OPERATION (STEP-BY- STEP)

- The voter comes at the voting station.
- The voter takes their finger on the fingerprint sensor.
- The system captures the fingerprint and verifies it.
- The camera captures the voter's face for face recognition.
- The system verifies both biometric inputs with stored records.
- If authentication is successful, the voting interface is activated.
- The voter casts their vote.
- The vote is encrypted and transmitted to the server using IoT.
- The database updates the voting status and blocks repeat voting.
- The system confirms successful vote submission

C. ARCHITECTURE DIAGRAM

[Voter]
|
[Fingerprint Sensor]
|
[Face Recognition Camera]
|
[Microcontroller / Control Unit]
|
[IoT Communication Module]
|
[Central Database Server]
|
[Result Monitoring System]

V. METHODOLOGY

This project online voting system is implemented step by step. In this system face recognition is used to identify the voter before voting. The main aim of this methodology is to allow only correct voter and stop fake voting.

Step 1: Voter Registration

First voter registers in the system. The voter enters basic information and face image is captured using webcam.

Step 2: Saving Face Data

The captured face image is stored in the database.
This data is used later for checking voter identity.

Step 3: Opening Voting Module

When election starts, voter opens the voting module from the system.

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Step 4: Camera Activation
At the time of voting, the system turns on the webcam automatically.

Step 5: Face Capture
The live face image of voter is captured through the camera.

Step 6: Face Detection
The system detects face from image using Haar Cascade method.

Step 7: Face Processing
After detecting face, the system processes face data using LBPH technique.

Step 8: Face Verification
The processed face data is checked with the face data stored in database.

Step 9:Biometric Verification
The system captures the voter's biometric data such as face or fingerprint using a sensor.

Step 10: Vote Permission
If the face is matching, voter is allowed to give vote. If not matching, voting is stopped.

Step 11: Vote Storage
After voting, the vote is saved in the system and same voter cannot vote again.

VI. FEATURES OF THE SYSTEM

The Safe and Modern Voting
Voting becomes secure, simple, and reliable. No more paper ballots—everything is digital and smart.

Biometric Verification
Uses face scans and fingerprints to make sure Only real voters can vote.

Face Recognition
You scan your fingerprint, which is unique to you. Ensures accurate voter identification.

Double Security
Both face and fingerprint are needed to vote.

Automatic Vote Recording
Votes are counted automatically.
No manual counting, which saves time and avoids mistakes.

No Duplicate Voting
The system updates after every vote.
If someone tries to vote again, it won't allow it.

Safe Data Storage
Voter information is stored digitally and securely. Only authorized people can access it.

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Easy to Use
The screen is simple and clear.
Even first-time voters can easily cast their vote.

Less Human Involvement
Most steps are automatic.
Reduces mistakes and chances of tampering.

Faster Voting
Voting is quick, so voters do not have to wait in long lines.
Accurate and Reliable
Automation ensures precise vote counting. Results are dependable.

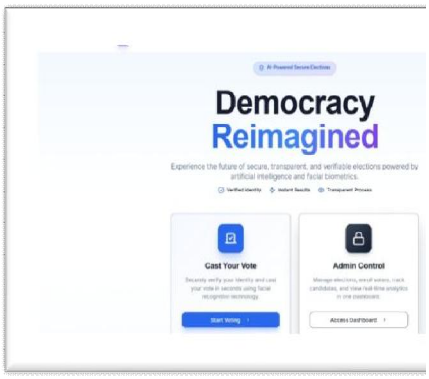
Flexible and Scalable
Works for small elections and can expand to large ones.
Adapts easily to different needs.

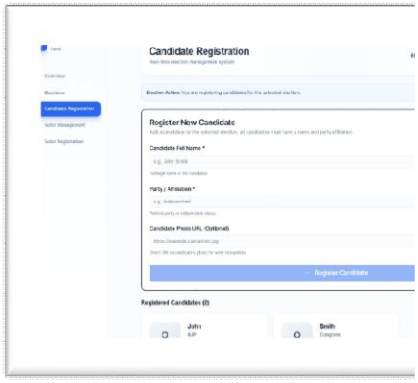
Easy Setup and Access
Can be installed at multiple locations.
Can also be monitored remotely via the internet.

Cost-Effective
Saves money over time by reducing paper and manpower.

Eco-Friendly
Mostly paperless, reducing waste and supporting green elections.

VII. OUTPUTS AND RESULTS





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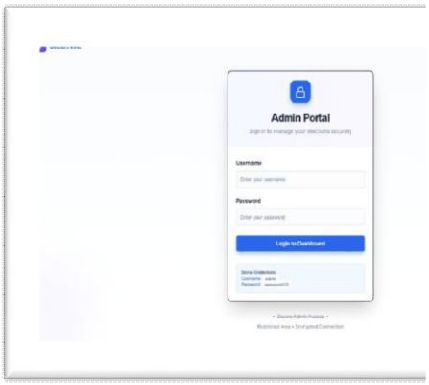

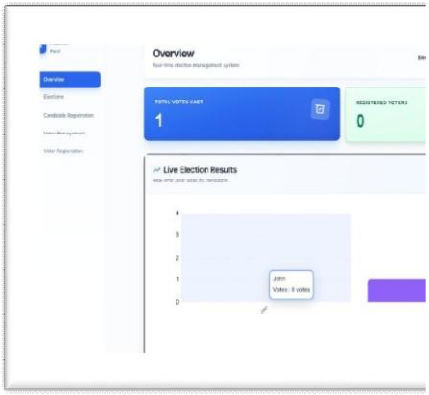

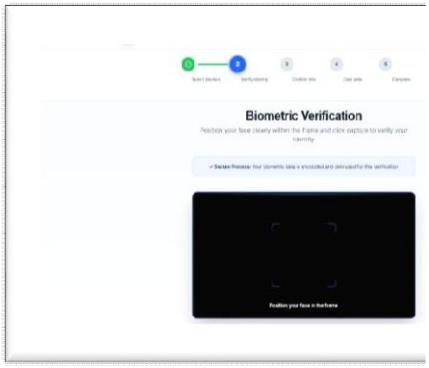

VIII. SECURITY MECHANISM

In a Smart Voting System using IoT, one of the main problems is wrong or unauthorized voting. Since voting is done using electronic devices and the internet, there is a chance that an unapproved person may try to vote. Sometimes, the same person may also try to vote again. This can reduce trust in the voting process.

To solve this problem, the system uses a voter checking security method. Before voting starts, simple details of each voter such as voter ID, fingerprint, face image, or login details are saved in the system. These details work as the voter's identity.

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When a person tries to give a vote, the system first checks their details with the saved information. If the details are correct, the system allows the person to vote. If the details are wrong or if the person has already voted, the system stops the voting access.

This method makes sure that only real and registered voters can vote. It helps to stop fake voting and repeat voting. Because of this, the smart voting system becomes safer and easier to trust.

IMPORTANT SECURITY MECHANISM POINTS

1. Stops wrong and fake voting
2. Allows only registered voters
3. Stops the same person from voting again

IX. APPLICATIONS

Secure Government Elections

Ensures only registered voters can vote Prevents fake and duplicate voting

Voter Identity Verification

Uses face recognition for identity checking Fingerprint authentication adds extra security

Elimination of Impersonation

No one can vote on behalf of another person Biometric data is unique for every voter

Automatic Vote Counting

Votes are counted digitally Reduces human effort and mistakes

Faster Result Declaration

Results are generated instantly

Saves time compared to manual counting

College and University Elections

Useful for student council elections

Simple and quick voting process for students

Remote Monitoring Using IoT

Voting data can be monitored in real time Authorities can check system status remotely

Reduction of Paperwork

No need for ballot papers Environment-friendly system

Time-Saving for Voters

Reduces long waiting lines

Voting process is quick and smooth

X. ADVANTAGES

- The system makes it very easy for people to vote using machines, so voting is faster and better than using paper.
- It removes problems like long lines, waiting a lot, and extra work, so voting is simple and smooth for everyone.
- Only people who are registered can vote, so no one else can cheat and the election becomes fair.
- It is very easy to use and does not need any special knowledge, so anyone can vote without any trouble.
- The system saves time because voting is fast, and can also count votes as its own, which stops mistakes.

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• By stopping cheating and mistakes, the system makes people trust the voting and feel it is safe.
• It also uses less paper and tools, makes voting clear, easy, and better for nature.

XI. LMITATIONS OF THE SYSTEM

The Smart Voting System that uses Internet of Things is an efficient way to hold elections. We have to think about some problems with this system. The Smart Voting System really needs the internet to work. So if the internet is slow or not working all it can cause problems, with voting. If the internet connection is not stable people may have to wait to submit their votes. They may not be able to use the system for a little while. The Smart Voting System can be affected by these internet issues.

Security is a worry. Even though we have things like encryption and authentication to help keep things systems that use Internet of Things technology are still not completely safe from bad people trying to hack or intercept data or get in without permission. If we do not keep updating the security measures all the time the information about voters and the results of elections may be in danger. We need to make sure Security of Internet of Things technology is strong to protect voter data and election results. Security measures, for Internet of Things technology have to be updated. The system's requirement for first voice registration is another drawback.

The system also depends on things like sensors and microcontrollers and servers. If the hardware breaks down or the power goes out or a device gets damaged it can affect how well the system works. You might lose data or the votes might not get recorded correctly. You have to take care of the system so it keeps working properly. The system and the devices, like sensors and microcontrollers and servers need to be checked.

Important Restrictions

We need the internet to work properly so that people can vote without any problems. The internet has to be working all the time for voting to happen smoothly. We are talking about internet connectivity, for voting operations that are not interrupted.

The security of a system really depends on having encryption and doing regular software updates. This is very important for system security. System security is what keeps our information safe so we need to make sure we have encryption and we are doing regular software updates, for the system security.

When the hardware fails or there are problems with the power the system will not work well as it should. The hardware failures and power issues can really make a difference, in how the system performs. The system performance is what gets affected by these hardware failures and power issues.

The way we verify that a user is really who they say they are, which is called user authentication can be affected by the limitations of the sensors we use for user authentication or the environment, around us when we are doing user authentication.

XII. FUTURE SCOPE

The Smart Voting System Using IoT has a lot of room to grow and get better. Technology is moving fast especially when it comes the idea of using the Internet of Things, for voting can work but the Smart Voting System Using IoT can be improved so it can be used in big elections that really matter. The system needs to get better in the future. One thing that would make it better is adding biometric authentication techniques. Biometric authentication is a deal. It will really cut down on voting and people pretending to be someone else. This will make the system more secure. People will trust it more. Biometric authentication techniques, like recognition and fingerprint recognition will make a big difference.

The Smart Voting System Using IoT will be a way to vote because it will be safe and easy to see what is happening and it will work well. If we keep making the Smart Voting System Using IoT better we can use it for elections and it will help make voting better and more people will trust it and want to vote. The Smart Voting System Using IoT can help people vote in a way.

• AI-based fraud detection and voting pattern analysis
• Blockchain integration for secure and tamper- proof vote storage
• Cloud-based infrastructure for scalability and real-time access multi-language support for diverse populations

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- Multi-layer security and encrypted communication
- Real-time result monitoring and analytics dashboards
- Integration with smart government and e- governance systems

XIII. CONCLUSION

The Smart Voting System Using IoT is a way to make voting better. We need to make voting more secure and honest. In the world we live in today technology is changing fast. So it is very important that we hold elections in a way that's safe and fair. The Smart Voting System Using IoT was made to improve the voting system. The Smart Voting System Using IoT does this by reducing the work that people have to do by hand reducing mistakes and making the Smart Voting System Using IoT more secure and reliable. The old way of voting often has a lot of problems. You have to wait in line for a time. The process takes forever. The Smart Voting System Using IoT is a way of doing things. It uses machines and computers to make voting easier and faster. It uses devices that can talk to each other to make sure the votes are counted correctly. The votes are sent over the internet in a way. The system also checks to make sure losing it. This makes people trust the voting process more and voters feel more confident, in the project and the voting process and the security of the voting process.

authentication module to confirm the speaker. The laptop runs the command to control PowerPoint slides, movies, or PDF documents after it has been authenticated, and the results are shown on a projector.

Hands-free operation, real-time command execution, enhanced mobility, and safe access are just a few advantages of the laptop-based voice control. It frees the presenter from being sidetracked by manual gadget operation so they may concentrate on delivering content smoothly.

All things considered, this method turns out to be a useful, effective, and user-friendly option for professional, educational, and public presentation settings. It offers a safe and contemporary method of human–computer interaction, improves presentation quality, and saves time.

XIV. ACKNOWLEDGMENT

I want to sincerely thank our project guide, Mr. Vishal S. Patil , for all of his help, encouragement, and support during this project. His advice and thoughts were crucial in directing this endeavor and guaranteeing its effective conclusion. Additionally, I am grateful to the teachers and staff at Shri H.H.J.B Polytechnic, Neminagar, Chandwad, Dist: Nashik, for providing the tools, direction, and supportive environment needed for project development and learning.

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