

Ensuring Trustworthy Elections with Dual Biometric Verification Using Facial and Fingerprint Recognition

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Abstract - In a democratic country like India, the voting system plays a pivotal role as the mechanism through which people choose their leaders. Citizens can cast their votes using either traditional ballot paper or Electronic Voting Machines (EVMs). However, both methods are susceptible to risks such as rigging, tampering, illegal votes, fake votes, and multiple votes. To address these challenges, our research introduces an electronic voting system equipped with fingerprint sensors and face recognition technology. This innovative approach ensures a secure election process by using fingerprints and faces as unique identification features, minimizing the potential for rigging. During voter registration, fingerprints are captured, extracted, and stored in a database to prevent multiple registrations by a single individual. On voting day, individuals scan their fingerprints, which are then compared with the stored database for authentication. The incorporation of the Voter Identity Number and fingerprint verification helps eliminate numerous duplicate registrations, significantly increasing the authenticity of the voting process. Our system simplifies voting, offering voters instant information about candidates, live vote counts, and immediate results. This makes it easier for people to decide when they vote, enhancing the democratic process by providing accessible and current information. In conclusion, our online voting system project successfully addresses the challenges of rigging, tampering, illegal votes, fake votes, and multiple votes while incorporating extra features compared to the existing system.

Keywords-Electronic voting system's, Face recognition, Multiple votes, Fingerprint recognition, Authentication, Tampering, Rigging, Illegal votes.

I. INTRODUCTION

Electronic voting refers to voting using electronic means to either aid or take care of the chores of casting and counting votes depending on the particular implementation, e-voting may use standalone electronic machine (also called EVM) or computer to the internet. This concept describes an online electoral system for Indian election is proposed for 1st time there are number of voting system develop all over the world with each of them having its limitation's this system uses the fingerprint sensor to scan thumb of the voter's

in order to provide high performance with high security to the voting counter also as we use internet of things i.e.(IOT) to make the voting system more practical.

This system used to display the data-base of the user (voter). After receiving the Instruction from the polling officer, also the voter can use the touch screen to poll his/her vote.

The internet of things (IOT) is the inter-networking of physical devices, vehicles, building and other items embedded with electronics, software, sensors, actuators and network connectivity which enables these objects to collect and exchange data. The IOT allows objects to sense or controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based system, and resulting in improve efficiency, accuracy and economic benefit in addition to reduce human intervention.

In the existing system, the election process was preceding like cast the vote by showing the voter ID card at the polling booth and by pressing the button against the party symbol. But in that there is a chance of rigging. So, to avoid this we are incorporating the embedded systems into the election system by registering the fingerprints of every voter before election. Voting process is known as a process for a group by means of a meeting or democratic vote in orders to take a free decision.

The vote caster fingerprints will be taken and it will be extracted and saved in the database for the voter registration and authentication processes. Storing the information in the database will prevent more than one registration from a single person. The fingerprint sensor is used for fingerprint detection. Biometric logistics operates by procuring fingerprints from an individual, then decoction of a feature set from the acquired data, and comparing with reference stored in the database

II. MOTIVATION

Voting is a very important part of democracy. Rigging, illegal votes, multiple votes such possibilities are to be prevented for fair elections and to elect a true leader. The proposed system reduce all such cases and promotes fair elections.

III. PROBLEM STATEMENT

Put together, information technology, big data, AI, blockchain technology, cloud technology, IoT, and smart devices – can make a substantial and positive synergic effect on effectively address the online voting system. Therefore, we hope that the online system convergence will be deployed to facilitate the voters so as to reduce the frauds, increase the voting accuracy, more reliable voting, lesser time delays, increasing electorate participation providing user friendly interface etc. Thus providing a framework for fair elections. The development of an overall effective online voting system is anticipated in near future.

IV. RELATED WORKS

Although there are many researches works on online voting systems, here we have critically analyzed and summarized twenty research works and projects which are more relevant, recent and pertinent. It is observed that most the recent works addresses the issue of online voting and use of various information technologies.

In the year 2020, Vivek S K, et.al., developed a secure, transparent and decentralized e-voting system is proposed using the Hyperledger Sawtooth blockchain framework [1]. Restricted access of the system through election polling stations allows voters to cast their votes, which are recorded in the immutable blockchain state. Fairness and reliability of the election procedure due to nil possibility of vote manipulation. The issue of fairness and reliability of the election procedure due to nil possibility of vote manipulation was addressed. The technology/platform used were Angular 8, Node.js, Amazon RDS, and Sawtooth blockchain, Python with the APIs, Docker technology, Amazon Web Services (AWS).

In the year 2021, Shubham Gupta, Divanshu Jain, Milind Thomas Themalil developed a system where the voter is registered into the system database well before the time of election [2]. Now at the voting time, In the first step voter must verify his/her government identity such as Aadhar card or voting card with his/her proper picture, once it is verified, he/she moves to the second step. In second step voter has to go under the face reorganization process. Once the corresponding matching or verification is done, the voter will move to next step to cast vote to the candidate from the electronic voter machine. The cast vote is shown on display for the satisfaction of voters. Then the voting data is continuously uploaded on ThingSpeak server. The central office of election department can monitor the data in more reliable way so that no discrepancy/modification can take place later was addressed. The technology/platform used were PyCharm, JetBrains IDE using Python, IoT, ThingSpeak, Open Source Computer Vision Library OpenCV, Arduino.

In the year 2020, Naseer Abdulkarim Jaber Al-Habeeb, Dr. Nicolae Goga, Haider Abdullah Ali1, Sarmad Monadel Sabree AlGayar described an application for m-voting targeting the specific conditions of Iraq in the COVID situation [5]. In the current society, the application of which we are talking about, can also be seen as a significant help for a numerous amount of countries during the pandemic of COVID- 19. The application is based on Mobile technology. Mobile technology is chosen motivated by the fact that although people do not have computers, almost everyone has a mobile phone in Iraq. The technology/platform used were Android Studio, PHP- Restful Services for the BackEnd Component and MySQL database.

In the year 2021, Ganesh Prabhu S, et.al., developed the face scanning system is used to record the voters face prior to the election and is useful at the time of voting [7]. The offline voting system is improvised with the help of RFID tags instead of voter id. This system also enables the user the citizens to see the results anytime which can avoid situations that pave way to vote

tampering. This paper focusses on a system where the user can vote remotely from anywhere using his/her computer or mobile phone and doesn't require the voter to got to the polling station through two step authentication of face recognition and OTP system. The technology/platform used were Arduino Uno, LCD Display, RFID, Push Button.

In the year 2020, Shaikh Mohammad Bilal, Prince Ramesh Maurya developed Voting System utilizing Android Application is progressively effective that the great technique to do a political decision [11]. The task has build up an intuitive GUI board for casting a ballot framework. In addition, Apps Inventor 2 had been utilized to structure the whole task. The database that made additionally does the computation of the information before move the information to the official site. This framework has better exactness contrasted with the conventional strategy for tallying. The technology/platform used were Android applications.

V. IMPLEMENTATION & WORKING

A. Circuit Diagram

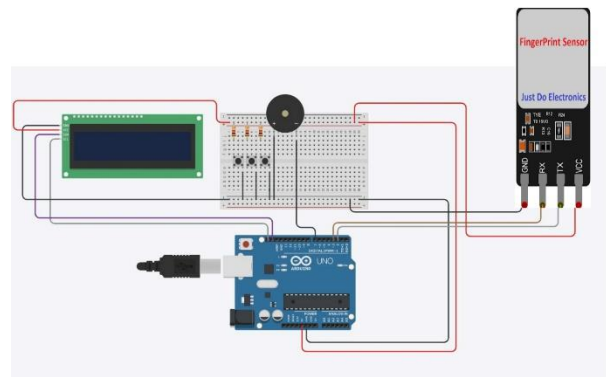


Fig. 1 : Circuit Diagram of the proposed system

B. Working

Develop a comprehensive system architecture that integrates both facial and fingerprint recognition technologies. This includes hardware (biometric scanners, cameras) and software (algorithms for biometric data processing, database management). Prior to the election, voters need to enroll their biometric data (facial features and fingerprints) into the system. This can be done at designated enrolment centers where their identified are verified using traditional methods (IDs, documents). Create a secure database to store biometric data, ensuring encryption and compliance with data protection regulations to safeguard voters privacy. On election day, voters present themselves at polling stations where their identities are verified through biometric scanners.

The system matches their facial features and fingerprints against the enrolled data to confirm their eligibility to vote. Ensure that the biometric verification process is fast and efficient to prevent long queues and delays at polling stations. Real-time processing is crucial for a smooth voting experience. Implement redundancy measures to ensure system reliability, such as backup servers and alternative power sources. Additionally, employs robust security protocols to prevent unauthorized access and tampering with the biometric data. Conduct thorough testing and piloting of the system prior to the election to identify and address any potential issues or weakness. Ensure that the implementation of dual biometric verification complies with electoral laws and regulations. Maintain transparency throughout voters and stakeholders. By these steps, elections can be conducted using facial and fingerprint recognition in a secure, efficient, and transparent manner.



Fig. 2: EVM Equipment used for voting process

The usual voting process is different from the proposed system as it involves two step verification i.e. Fingerprint verification by the sensor and Face Recognition by the camera module interfaced using the Arduino.

C. Flow Chart

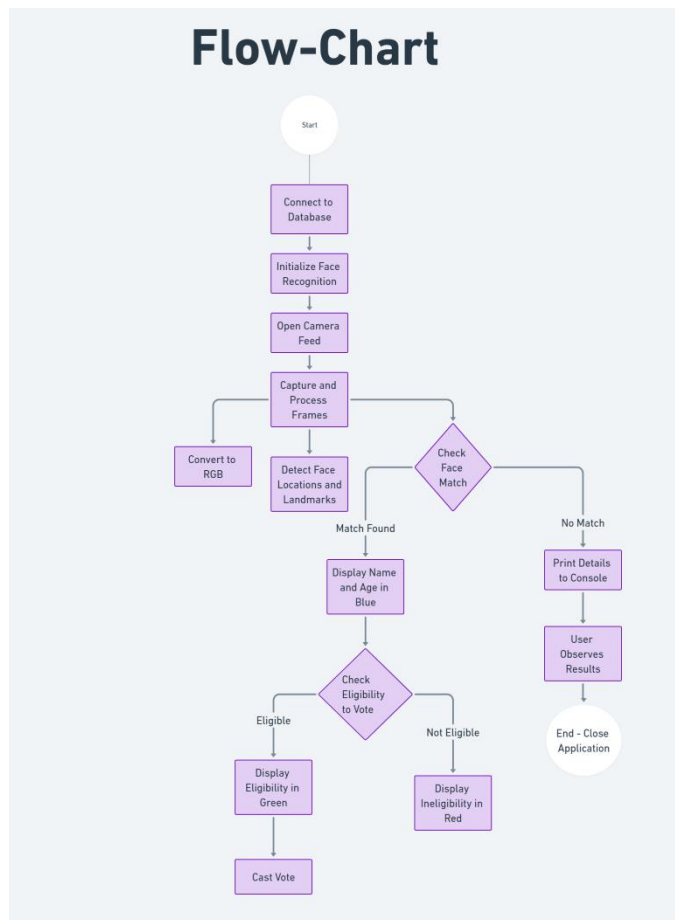


Fig. 3: Flow Chart describing the mechanism of the proposed system

The above flow chart completely describes the working of the proposed system. It starts from ensuring the connections and collection of the data through sources like the data base and then using that information further continue the process. It checks the information related to the voter and also count the votes that have been polled till then. At the end of the process, it gives the result as the winner amongst the candidates.

D. System Prototype

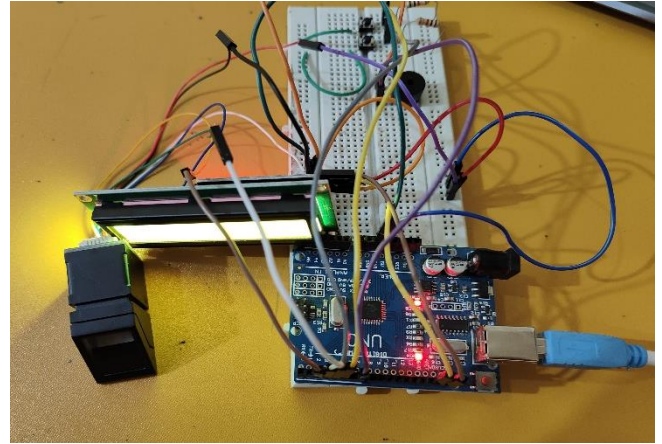


Fig. 4: Hardware setup of the voting system

VI. RESULTS

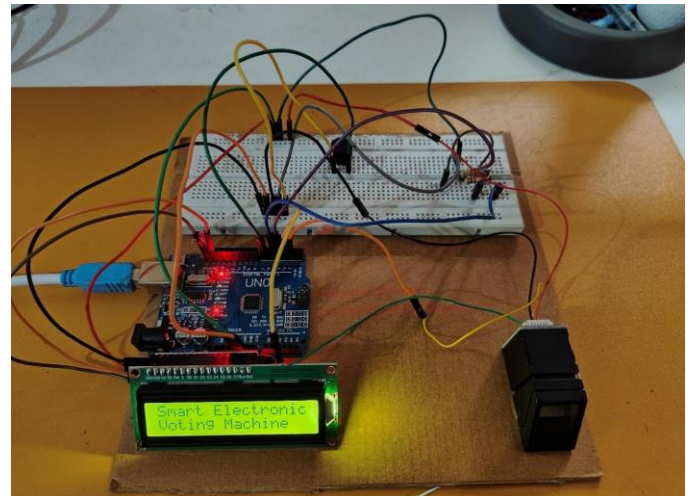


Fig. 5: Final prototype demonstration at the start of the procedure



Fig. 6: Displaying Welcome message in LCD



Fig. 7: Instructing to place finger on fingerprint sensor



Fig. 8: Displaying Voter id of the person placed finger.



Fig. 9: After Verifying Valid/Not displaying to Cast Vote



Fig. 10: Displaying Thank You For Voting after Successful Voting



Fig. 11: Same user with same id appeared again.



Fig. 12: Since same user tried to vote Buzzer is activated and not allowed to vote



Fig. 13: Resetting The display.



Fig. 14: Admin Placed finger to know the results



Fig. 15: Winner Party Displayed using no of votes casted for that party

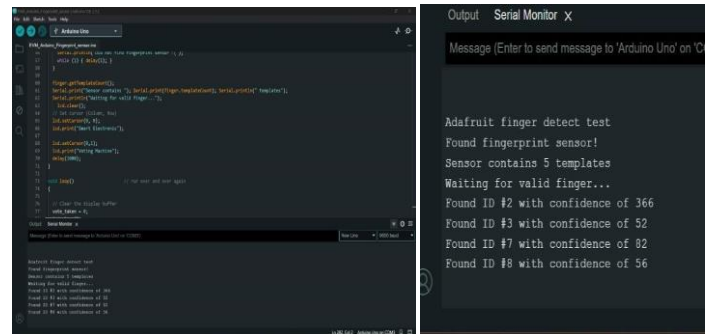


Fig. 16: Arduino IDE displaying No of voter fingerprints registered and theirs id's when placed finger.

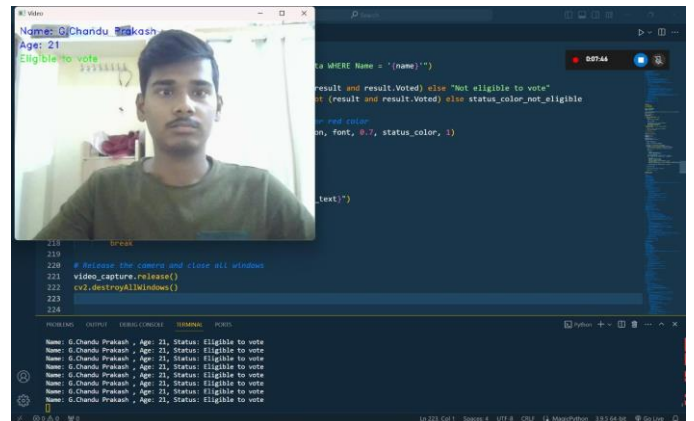


Fig. 17: User can Cast HIS/HER vote as he didn't entered the booth yet.

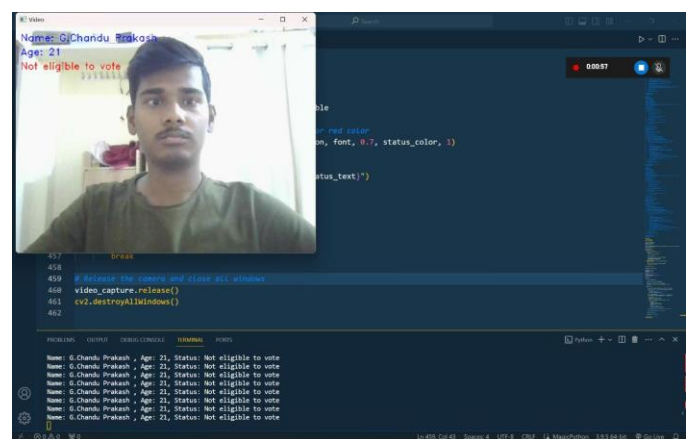


Fig. 18: User cant enter the booth as he already entered before this is done to prevent duplicate voting.

VII. CONCLUSION

In conclusion, the integration of face recognition and fingerprint sensors into a voting system, coupled with Arduino technology and buzzer feedback, represents a significant advancement in ensuring secure, accessible, and efficient voting processes. Through the development and testing of our prototype, we have demonstrated the feasibility and effectiveness of this approach in enhancing the integrity and inclusivity of electoral procedures.

By leveraging biometric authentication methods such as face recognition and fingerprint scanning, our system offers robust identity verification, mitigating concerns related to voter fraud and impersonation. The use of Arduino microcontrollers facilitates seamless integration and real-time processing of biometric data, enabling swift and accurate authentication of voters. Additionally, the incorporation of buzzer feedback provides immediate confirmation to voters upon successful authentication, enhancing user experience and instilling confidence in the voting process.

Moreover, the simplicity and user-friendliness of our voting system make it accessible to individuals of varying technological proficiency.

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