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Intelligent Voting System-A Survey

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Abstract: Election is a major event in India which uses the electronic voting system for voting. Security and authentication is a big issue in front of the election commission. This has been a motivation for the research on different voting systems. The allotment of a unique ID called Aadhaar can be used to fill the loopholes of the current system. The role of biometrics in the modern election systems has been a major upgrade to the previous traditional system which used paper ballots for voting, as it is a time consuming process and has authentication issues. The election system was completely changed by electronic voting machine in which the whole process is carried out by the machine itself i.e. no need of ballot paper, boxes, stamps, etc. But authentication issues still persist with this system. The biometric system is found to be a reliable solution to the aforementioned problem. The biometrics is the study of physical movements and behavioral characteristics of human include items such as iris, finger prints, voice, face etc. Biometric identifiers cannot be easily misplaced or tampered with. This paper is a discussion of different voting systems with their advantages and drawbacks. A proposal of a new voting system that uses the fusion of fingerprint recognition and Aadhaar ID to cast a vote has been done.

Keywords: Aadhaar ID, Fingerprint, Voting system.

I. INTRODUCTION

The elections are an important aspect of administration of every democracy. It is the process by which the population can choose their representative and express their choice of the ruling party who can provide proper guidance towards welfare of the society. This process is carried out with a simple method called voting in which every member of the population is allowed one vote to choose his or her preferred candidate. The main requirements of election system are authentication, speed, accuracy, transparency and security. The election system must be robust enough to withstand a variety of malpractices and must be convenient enough so that voters and candidates can have a smooth election experience. Malpractices include voting on behalf of dead people, voting on behalf of unavailable people, single person casting multiple votes, issues related threatening.

A number of voting systems have been adopted all over the world to satisfy the requirements mentioned above and simultaneously overcoming the drawbacks. Each voting system has its own pros and cons. Following figure depicts the various types of voting systems that have been used or are in use in today's era.

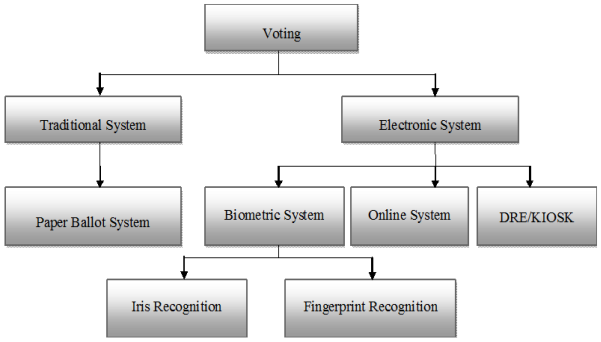

Fig.1 Voting Systems

A new system is designed keeping in mind the necessity to overcome the drawbacks of the existing system. This leads to stepwise improvement in the voting systems. The focus of this paper is on discussion of traditional voting system to the voting systems being used now.

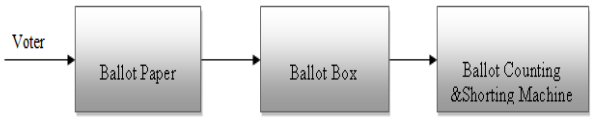

Fig.2 Paper Ballot Voting System Systems

II. RELATED WORK

A. Paper Ballot Voting System:

Before the Electronic Voting System [1] was introduced to the world, the Paper ballot system was the widely used traditional voting system. In this system, the vote is cast using a paper and a stamp. One ballot is given to one voter and no sharing takes place. In regular elections, each voter may write the name of candidate personally on a piece of paper which serves as a ballot. However, in governmental elections pre-printed sheets are used to maintain the secrecy of the votes [2]. The ballot is cast by the voter in a box at a place called the polling station.

Advantages of Paper Ballot Voting System:

- Less costly: As only a paper and a ballot box are the main requirements of this system, it is very much cheap and affordable than the electronic system.
- Simplicity: No guidance is required for the individual to cast his/her vote. This system is so simple that even illiterate people can cast their vote easily.
- Portable: The arrangement and assembly of the whole system is very simple and can be done easily and quickly with the help of sufficient man power.

Disadvantages of Paper Ballot Voting System

- Time Consuming: In this system only one person can cast his vote at a time and others have to wait in a queue for their turn. Hence, it is very slow and time taking.
- Low Tally Speed: After the voting sessions are over, the ballot boxes are taken to a specific place and then the counting process is carried out. Hence, the result declaration takes a lot of time.
- Booth Capture: In some cases the polling stations were taken under control by party loyalists and it was the major type of electoral fraud found in India.

B. Electronic Voting System:

In the electronic voting system an electronic ballot is used that allows voters to use the internet to broadcast their secret vote ballot to election officials [3]. To increase the participation of the people in election, it was important to make the voting process a convenient one. The use of electronic voting was started by inventors to make this happen as the internet prospered over the years [4]. Since then improving the feasibility of the electronic voting system has been the main area for which the engineers have repeatedly created new technology [5].

Advantages of the Electronic voting system:

- Convenience: With the well-designed software and system, the voting process can be finished easily by the voter with minimal time and skill by simply using his/her voting equipment.
- Mobility: Location is no more a constraint as people can cast votes from any place from where they can access the internet. Voting can even be done using a mobile device such as a cell phone or PDA.
- Flexibility: This system can be designed not just for the regular voting process but also for supporting different question formats such as collecting public opinion.
- Less Cost: The initial investment for the setup of the whole electronic voting system would be high. However, the expenses for location management, administration fee, personnel etc. would be very low. Thus, the total expense would be low as compared to traditional ballot system once the system is up and running.
- Tally Speed: The calculation of the result of the election is done by the system itself once the voting time is over, which makes the electronic system much faster than the traditional voting system in this aspect.

Disadvantages of Electronic Voting System :

- Vulnerable to Security: There are many types of attacks which are difficult to stop completely. Thus, security issue is the main concern of the electronic voting system.
- Power: Many polling booths are located in such places where there is no or irregular supply of electricity. Thus, the machines have to be entirely operated using batteries.
- Cost: The electronic voting machines use parts which are expensive and the hence the complete set up becomes very expensive. Thus cost of the system is a major concern.

C. **DRE (**Direct Recording Electronic Systems):

Direct Recording Electronic Systems (DRE) are the recent type of vote-counting systems in which the touch screen system is employed. DRE is considered the first full computer based system [17]. All steps in the voting process, i.e. registration, ballot casting, counting etc. are performed by the DRE machine. DRE systems consist of buttons and areas on the touch screen. A voter has to show their ID to the election officer and then the voter is given a PIN or smart card. Voters can either enter the PIN or the smart card into the DRE.

The choices are displayed to the voter on the screen and he/she makes the choice. Finally the DRE gives the voter an option to change his/her choice or finalize the choices. The computer's memory stores the votes. Hence, the DRE is the only example of completely electronic voting machines. There are other types of DRE equipped with printed audit trails which is often called Direct Recording Electronic System- Voter Verified Paper Audit Trail (DRE-VVPAT). That is, a touch screen based machine that produces a printout of each vote, verified directly by the voter, to maintain physical and verifiable record of the votes cast [18].

D. Online Voting System:

The latest system introduced is the Online Voting System. In this the web browser is used to transmit the voted ballot [5]. This system is independent of the location of the voter. It has good efficiency and portability. However, security is a major concern.

Online Voting System [16] based on Aadhar Id verification is proposed. In this paper a voting system is conducted based on unique number for enrolment of particular user. A framework is designed which is expected to be more secure and free from accessing by any unauthorised user. But in this system user id and password based authentication is used which is not much secure

Advantages of Online Voting System:

- Portable: It requires only a device which supports the internet as the system works on the internet.
- Fast: The voting takes place on a single click. There are no queues like that of traditional ballot voting system and hence much faster than traditional paper ballot voting system.
- Flexibility: Different question formats can also be supported in this system because of the use of internet.
- Mobility: For voters who are regularly out of station, this system is very beneficial as it gives the freedom of casting the vote from anywhere in country.
- Reusability: This system can be reused a number of times without any technical difficulties.

Disadvantages of Online Voting System:

- Complexity: The database maintained by this system is very large and it deals with large number of users. Hence, the designing phase of this system is highly complex.
- Security Issues: Security issue is the main concern of this system. The system more susceptible to online threats as the whole system operates over the internet.

- High Expense: This system is very much costlier than the other systems because various equipments and utilities are required to be purchased which are quite costlier.

E. Biometric-Secure e-Voting
The design of the Biometric system guarantees the community that there will be no false voting in the election. Hence the percentage of voting user increases automatically. Also main focus of Biometric e-Voting is achieving the election integrity. But the system is not employed in real world using fingerprint scanner. [15]

i. Iris recognition:
Iris recognition is a method of biometric authentication that uses pattern recognition techniques based on high resolution images of the irises of an individual's eye. [9]

ii. Fingerprint recognition:
GSM based voting system [10] consists of two modes – normal mode and security mode. In normal mode, the person needs to be present in nearby locality as specified. In security based, the person present in any part of the world is allowed to vote.

In this system a particular user is enrolled and authorised using a single fingerprint scanner. But this system is not flexible as it is limited to specific region. Also, the error rate i.e. FRR (False Rejection Rate) is very low. The FRR rate of this system is found to be 1.4%.
Moodle [13] is a software package used for creating different course and internet based websites. Fingerprint matching is used for registration of student to access the website. Fingerprint image is used as the authentication in login window for studying certain courses. Fingerprint biometric authentication is found to be more secure than password based system.

III.TECHNIQUES USED IN BIOMETRIC RECOGNITION

A. Minutiae based algorithm
In this technique, database is created by creating a new template of two fingerprint images of each person. The FRR rate obtained by using the algorithm in [11] is found to be 0.4% which is very low. The orientation and reference points are considered to extract the minutiae positions from the fingerprint image. The template is stored in the database by selecting reference points from first and orientation field from the second fingerprint. During authentication phase, the input is the fingerprint images which are matched with the template stored in the database. If the input matches with it, the user gets authenticated.[11]

B. Latent Fingerprint Matching technique
In this technique, different techniques are used for the smudgy and damaged fingerprint images which are not authenticated. For improving robustness & distortion in fingerprint image Hough transform is used. In this process minutiae positions are extracted by using two types of methods - manual marking and automatic marking. The latent fingerprint matching technique produces very low accuracy while using normal fingerprint images and is found to be more efficient in smudgy fingerprint image than normal ones.[12]

C. Threshold Cryptographic technique
One of most important fingerprint matching technique is Threshold Cryptographic [14] technique. In this technique, cryptography is used to divide the fingerprint image into two or more shares and then compression is applied for compressing image in database. Database is created for a particular user with the first part of share and other is given with the user. If both shares match, the user gets authenticated. The error rate i.e. FRR by using threshold cryptography is low.

D. Corner Detection Based Iris Encoding
An iris recognition algorithm using corner detection is presented in [8]. Iris texture is selected as feature to be extracted. There are two sub steps involved in the localization step, pupil detection followed by outer iris localization. In this technique the main idea is to find curves which can be defined by formulae such as polynomials, straight lines, circles, etc., in a suitable parameter space. In the first step the author has convolved with the sobel filters to find intensity image gradient at all the locations in the given image.

Covariance matrix is used to detect corners in the normalized iris image. Then, the cross correlation coefficients are found using the detected corners between the database and query image. The candidate is accepted by the system if the number of correlation coefficients between the detected corners of the two images is greater than a threshold value. Gupta el al. [19]

From the experimental results it is found that the recognition system is showing an overall accuracy of 95.4 % with FRR of 5% and FAR 4%.

E. Haar wavelet
Haar wavelet transform is used for calculation of iris features by Singh et al. [20]. They performed five level wavelet decomposition showing all detail and approximation coefficients using Haar wavelet. Then the coefficients that represent the core of the iris pattern are chosen and those consist redundant information are eliminated. On observation it can be noticed that its diagonal components are almost similar so redundancy can be reduced by selecting only one of them. A single vector is formed by similarly considering some of vertical and horizontal components thus characterizing the iris patterns. This vector is called the feature vector [21]. The complete image will have a fixed feature vector if all mapped image is fixed size. This vector has a size of 702 elements. Daugman [22] has used vector of 1024 elements. Hence, this technique has successfully managed to reduce the feature vector. This feature reduction has been obtained as mapping is done only on the lower part of the iris contrary to the regular method in which we include the whole iris of which some part is obscured by the eyelashes hence obtaining almost half his feature vector's size.

IV. PROPOSED METHOD

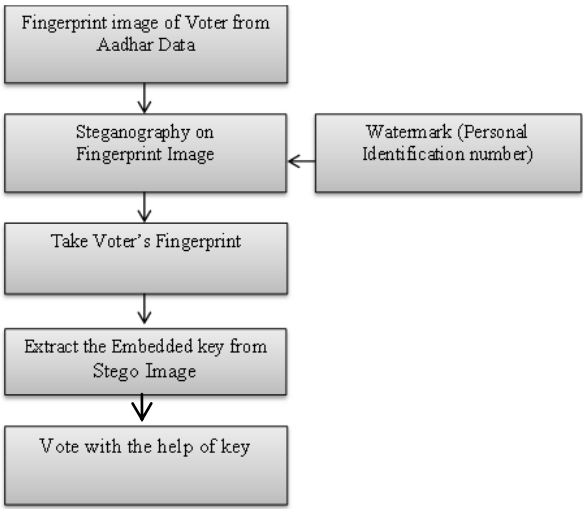

Fig.3 Proposed Systems

V. CONCLUSION

The last few years have brought a renewed focus on to the technology used in the voting process. The current voting system has many security issues and it is difficult to prove even simple security properties about them. A voting system that can be proven correct has many concerns. Some reasons for a government to use electronic systems are to increase voter convenience and to reduce the elections expenses. Still there is some scope of work in electronic voting system because there is no way of identification by the electronic voting system whether the user is authentic or not and securing electronic voting machine from miscreants.

This survey paper can be helpful for finding the Pros and cons of current voting systems. A comparative study all these systems would definitely help in developing a new system that combines all the advantages and overcomes the drawbacks of these systems.

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