

# Biometrics using Electronic Voting System with Embedded Security

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**Abstract**—An electronic voting (e-voting) system is a voting system in which the election data is recorded, stored and processed primarily as digital information. There are two types of e-voting: On-Line and Offline. On-line, e.g. via Internet, and offline, by using a voting machine or an electronic polling booth. Authentication of Voters, Security of voting process, Securing voted data are the main challenge of e-voting. This is the reason why designing a secure e-voting system is very important. In many proposals, the security of the system relies mainly on the black box voting machine. But security of data, privacy of the voters and the accuracy of the vote are also main aspects that have to be taken into consideration while building secure e-voting system. In this project the authenticating voters and polling data security aspects for e-voting systems was discussed. It ensures that vote casting cannot be altered by unauthorized person. The voter authentication in online e-voting process can be done by formal registration through administrators and by entering One time password. In Offline e-voting process authentication can be done using Iris recognition, finger vein sensing which enables the electronic ballot reset for allowing voters to cast their votes. Also the voted data and voters details can be sent to the nearby Database Administration unit in a timely manner using GSM System with cryptography technique.

**Keywords**—,Iris Recognition; Fingerprint; Offline e-voting; Online e-voting; Electronic Voting

## I INTRODUCTION

As the modern communications and Internet, today are almost accessible electronically, the computer technology users, brings the increasing need for electronic services and their security. Usages of new technology in the voting process improve the elections in natural. This new technology refers to electronic voting systems where the election data is recorded, stored and processed primarily as digital information. In the past, usually, information security was used mostly in military and government institutions. But, now need for this type of security is growing in everyday usage. In computing, e-services and information security it is necessary to ensure that data, communications or documents (electronic or physical) are enough secure and privacy enabled. Advances in cryptographic techniques allow pretty good privacy on e-voting systems.

Security is a heart of e-voting process. Therefore the necessity of designing a secure e-voting system is very important. Usually, mechanisms that ensure the security and privacy of an election can be time-consuming, expensive for election administrators, and inconvenient for voters.

There are different levels of e-voting security. Therefore serious measures must be taken to keep it out of public domain. Also, security must be applied to hide votes from publicity. There is no measurement for acceptable security level, because the level depends on type of the information. An acceptable security level is always a compromise between usability and strength of security method.

The authenticating voters and polling data security aspects for e-voting systems are discussed here. It ensures that vote casting cannot be altered by unauthorized person. The voter authentication in online e-voting process can be done by formal registration through administrators and by entering OTPCertificate. In Offline e-voting process authentication can be done using facial recognition, fingerprint sensing and RFID (smart cards) which enables the electronic ballot reset for allowing voters to cast their votes. Also the voted data and voters details can be sent to the nearby Database Administration unit in a timely manner using GSM System with cryptography technique.

The criteria are Registration through Administrator, Voter identification and verification process is done through GSM with one time password. The second Offline e-voting process includes Facial Recognition; Fingerprint sensing, RFID and Polling data processing using Cryptography Technique with RC4 Algorithm. The final process concludes the analysis of polling data in real time and immediate resulting system of e-voting system.

## II ELECTRONIC VOTING SYSTEMS

An electronic voting system is a voting system in which the election data is recorded, stored and processed primarily as digital information. E-voting is referred as “electronic voting” and defined as any voting process where an electronic means is used for votes casting and results counting. E-voting is an election system that allows a voter to record their ballots in a electrically secured method. A number of electronic voting systems are used in large applications like optical scanners

which read manually marked ballots to entirely electronic touch screen voting systems. Specialized voting systems like DRE (direct recording electronic) voting systems, RFID, national IDs, the Internet, computer networks, and cellular systems are also used in voting processes.

#### A. Securities of the E-voting systems

The main goal of a secure e-voting is to ensure the privacy of the voters and accuracy of the votes. A secure e-voting system satisfies the following requirements, *Eligibility*: only votes of legitimate voters shall be taken into account; *Unreusability*: each voter is allowed to cast one vote; *Anonymity*: votes are set secret; *Accuracy*: cast ballot cannot be altered. Therefore, it must not be possible to delete ballots nor to add ballots, once the election has been closed; *Fairness*: partial tabulation is impossible; *Vote and go*: once a voter has casted their vote, no further action prior to the end of the election; *Public verifiability*: anyone should be able to readily check the validity of the whole voting process.

#### B. Issues of Present Voting System

There have been several studies on using computer technologies to improve elections these studies caution against the risks of moving too quickly to adopt electronic voting system, because of the software engineering challenges, insider threats, network vulnerabilities, and the challenges of auditing. *Accuracy*: It is not possible for a vote to be altered eliminated the invalid vote cannot be counted from the finally tally. *Democracy*: It permits only eligible voters to vote and, it ensures that eligible voters vote only once. *Privacy*: Neither authority nor anyone else can link any ballot to the voter *verifiability*: Independently verification of that all votes have been counted correctly. *Resistance*: No electoral entity (any server participating in the election) or group of entities, running the election can work in a conspiracy to introduce votes or to prevent voters from voting. *Availability*: The system works properly as long as the poll stands and any voter can have access to it from the beginning to the end of the poll. *Resume Ability*: The system allows any voter to interrupt the voting process to resume it or restart it while the poll stands

The existing elections were done in traditional way, using ballot, ink and tallying the votes later. But the proposed system prevents the election from being accurate. Problems encountered during the usual elections are as follows:

- It requires human participation, in tallying the votes that makes the elections time consuming and prone to human error.
- The voter finds the event boring resulting to a small number of voters.
- Deceitful election mechanism.
- Constant spending funds for the elections staff are provided

So, the proposed electronic voting system has to be addressed with these problems.

#### C. Proposed system of online e-voting

The process of voter registration before the election process is always done by Administrator as follows the before. Registration phase begins by storing the Voter information

such as Unique Voter ID (11-digit number TN/99/0000012— In this, TN specifies the State, Next two digit specifies District Id and third one specifies the Unique id for each eligible voter), Name, Age, Sex, Address and District in the database, polling questions answer and GSM one time password .this condition are stratification means person has valid the polling section.

### III OFFLINE E-VOTING SYSTEMS

#### A. Fingerprint Recognition

Fingerprint recognition or fingerprint authentication refers to the automated method of verifying a match between two human fingerprints. Fingerprints are one of many forms of biometrics used to identify individuals

and verify their identity. A fingerprint looks at the patterns found on a fingertip. There are a variety of approaches to fingerprint verification. Some emulate the traditional police method of matching pattern; others use straight minutiae matching devices and still others are a bit more unique, including things like moiré fringe patterns and ultrasonic. A greater variety of fingerprint devices are available than for any other biometric. Fingerprint verification may be a good choice for in e-voting systems, where you can give users adequate explanation and training, and where the system operates in a controlled environment. It is not surprising that the workstation access application area seems to be based almost exclusively on fingerprints, due to the relatively low cost, small size, and ease of integration of fingerprint authentication devices that will be implemented is shown in Fig.1.

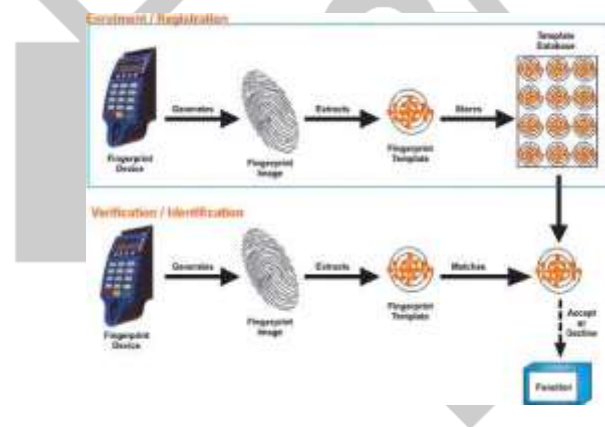


Fig. 1. Finger Print Enroiment and Verification

#### B. Facial recognition

Iris recognition systems have the same block diagram as any other biometric modality (see fig. 2). After capturing an image of the eye, the iris is located and segmented to extract its features; these features are then compared to a previously stored template .This section describes each of these blocks in detail, providing information on the approaches found in previous publications.

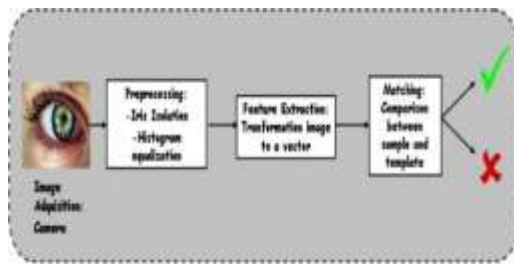


Fig .2 Iris biometric systems

Two different strategies are followed in offline biometric authentication systems: 1) the token provides the biometric template and 2) the token performs the verification tasks and supplies the result, avoiding external access to the user's personal template. This paper recommends the second strategy for security and privacy motivations. Thus, different architecture approaches to build personal tokens will be described. These tokens are designed as tamper-proof devices, maintaining not only internal data security, but also a secure communications channel with the external world.

#### A. Iris Acquisition

Contrary to popular belief, iris biometrics systems do not use laser-scans to capture the image of the human eye. Instead, an infrared photo or video camera is used at a set distance to capture a high quality image of the iris. Working in the infrared range provides many advantages when compared to the visible range: iris ridges, nerves, and crypts are more evident the border between the iris and the pupil is more pronounced; and users are not exposed to annoying flashes. Currently, most of the work performed in this area has been dedicated to improving user-system interaction by developing cameras where the focusing system is automatic, such that users are not required to remain steady at a fixed point in front of the camera.

#### B. Iris Segmentation

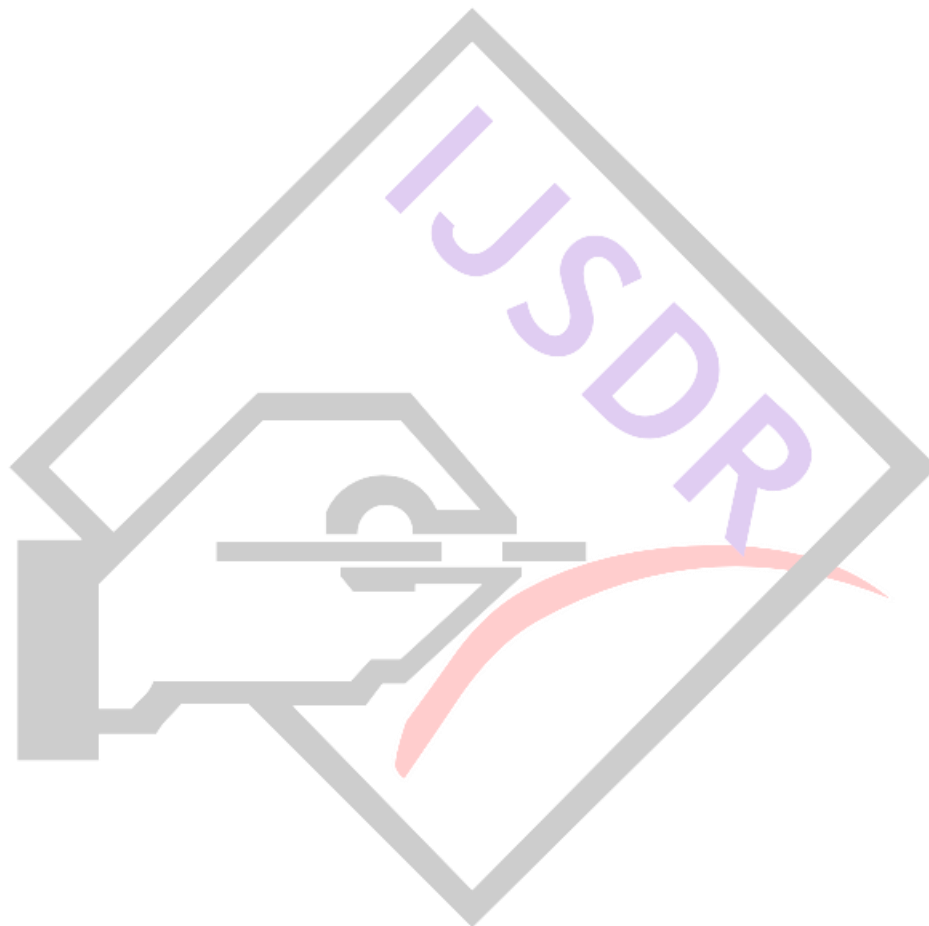
The main purpose of this process is to locate the iris on the image and isolate it from the rest of the eye image for further processing. Some other important tasks that are also performed in this iris segmentation block include image quality enhancement, noise reduction, and emphasis of the ridges of the iris. Several proposals have been made by different authors for iris location and segmentation, wherein most consider iris detection as finding two circumferences that model the iris boundaries. Daugman has proposed an integro-differential operator, which works by examining the difference in pixel levels between circles drawn in the image. Sanchez-Avila have used a similar operator, but search for the maximum difference in lines drawn crossing the entire image. Other authors use the Hough transform for circle detection. Recently, Daugman has proposed a new method for seeking the iris boundary by using active contour models. Here, the iris location varies depending on preset external and internal forces until an equilibrium state is reached. Similar solutions have also been used by Ritter and Ross.

#### C. Feature Extraction

In the feature extraction block, different authors have presented a wide variety of proposals. The majority of these begin with a normalization of the segmented iris image. This normalization becomes necessary when considering that the pupil varies in size for different light intensities. The normalization method varies from changes to the polar coordinate system, as Daugman proposed, to only considering a virtual line drawn around the pupil, known as the iris signature. After normalization, Daugman has studied the phase information by applying different Gabor filters. This was followed by the codification of this information in terms of the quadrant where the phase belongs; however, Wildes, performs the extraction using Laplacian or Gaussian filters by obtaining several images of different scales for posterior comparison. Sanchez-Avila *et al.* have proposed in two different feature extraction approaches: one using Gabor filters weighting for small portions of the segmented iris image and another one based on the use of dyadic wavelet transformations and their zero-crossing representation. Li Ma have proposed a similar approach, but applies the dyadic wavelet transformation on a 1-D intensity signal instead of the iris signature approach used by Sanchez-Avila. Boles have also based their proposal on the dyadic wavelet transform, but on a normalized iris image (as proposed by Daugman), i.e., by using a 2-D wavelet transform on the polar scale representation of the iris, as opposed to the two previous algorithms that work in 1-D.

#### D. Matching

Although some authors have studied other matching algorithms the most employed matching algorithm has been the Hamming distance, as was initially proposed by Daugman. The Hamming distance is described by the following equation: where  $L$  is the vector length and are the component of the template and sample vector, respectively, which are XOR in the equation. If the distance obtained is below a predefined threshold level, the studied sample is considered to belong to the user whose template is being studied. Selection of the threshold level usually depends on the final application.





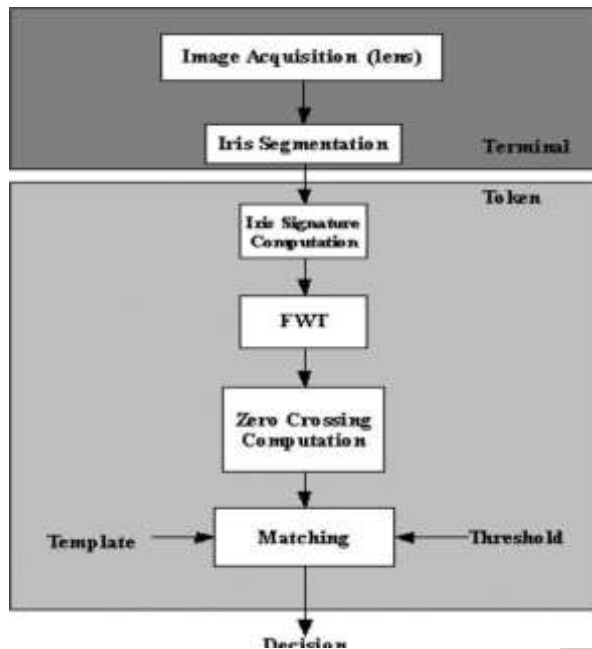


Fig.3.Terminal and platform functionalities.

### C. Finger Vein

Finger vein has three hardware modules: image acquisition module, DSP main board, and human machine communication module. The structure diagram of the system is shown in Fig. 4. The image acquisition module is used to collect finger-vein images. The DSP main board including the DSP chip, memory (flash), and communication port is used to execute the finger-vein recognition algorithm and communicate with the peripheral device. The human machine communication module (LED or keyboard) is used to display recognition results and receive inputs from users.

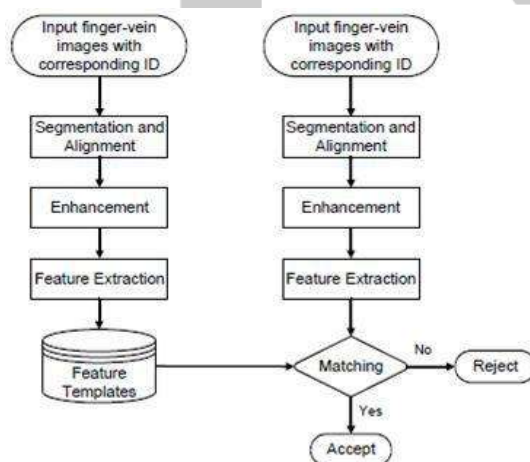


Fig.4.The flow-chart of the proposed recognition algorithm

The proposed finger-vein recognition algorithm contains two stages: the enrollment stage and the verification stage. Both stages start with finger-vein image pre-processing, which includes detection of the region of interest (ROI), image segmentation, alignment, and enhancement. For the enrollment stage, after the pre-processing and the feature extraction step, the finger-vein template database is built. For the verification stage, the input finger-vein image is matched

with the corresponding template after its features are extracted. Fig. 4 shows the flow chart of the proposed algorithm. Some different methods may have been proposed for finger-vein matching. Considering the computation complexity, efficiency, and practicability, however, we propose a novel method based on the fractal theory, which will be introduced in Section 4 in detail

### A. Image acquisition

To obtain high quality near-infrared (NIR) images, a special device was developed for acquiring the images of the finger vein without being affected by ambient temperature. Generally, finger-vein patterns can be imaged based on the principles of light reflection or light transmission. We developed a finger-vein imaging device based on light transmission for more distinct imaging.

Our device mainly includes the following modules: a monochromatic camera of resolution  $580 \times 600$  pixels, daylight cut-off filters (lights with the wavelength less than 800 nm are cut off), transparent acryl (thickness is 10 mm), and the NIR light source. The structure of this device is illustrated in Fig. 5. The transparent acryl serves as the platform for locating the finger and removing uneven illumination.

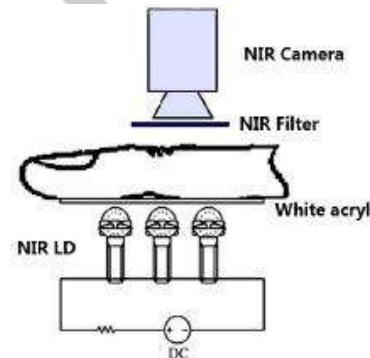


Fig.5.An example raw finger-vein image captured by our device

The NIR light irradiates the backside of the finger. In, a light-emitting diode (LED) was used as the illumination source for NIR light. With the LED illumination source, however, the shadow of the finger-vein obviously appears in the captured images. To address this problem, an NIR laser diode (LD) was used in our system. Compared with LED, LD has stronger permeability and higher power. In our device, the wavelength of LD is 808 nm. Fig. 6 shows an example raw finger-vein image captured by using our device.

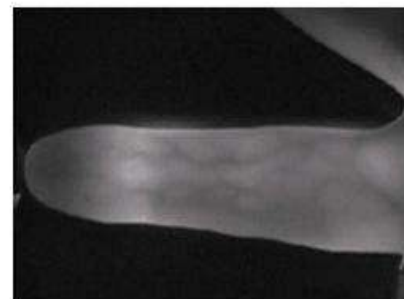


Fig.6. Illustration of the imaging device

## VOFFLINE E-VOTING PROCESSES

When the voter enters the voting place, he must have same kind of valid identity, which has been stored in the database for Verification. Authorized person choose to offline e-voting system. Thereare threeconditions for valid identity Verification to allow polling sectionsystem that will be implemented is shown in Figure 5

**condition1:** Capture the Iris image and compare or match to database, captured Iris image and database Iris image matched means that person will be valid for next condition otherwise exit the person.

**Condition2:**Capture the finger vein image and compare or match to database, capture finger vein and database finger veinmatched means this person will be valid for polling section and if two conditions are stratified automatically, E-voting machine buttons will be activate otherwise deactivate buttons.

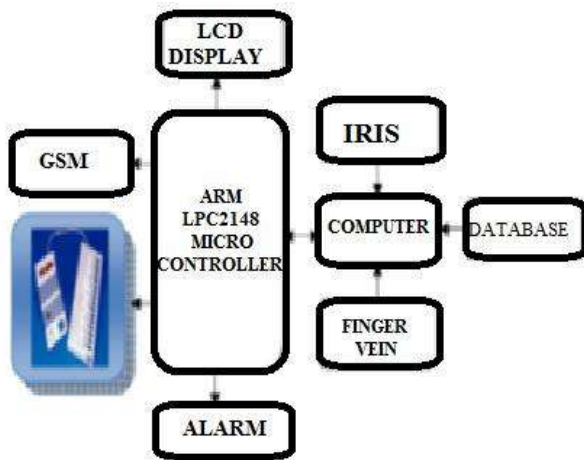


Fig.7. Offline E-Voting Block Diagram

## VIONLINE E -VOTING PROCESS

When the voter enters the voting place, he must have same kind of valid identity, which has been stored in database verification, authorized person choose to online e-voting system. Two conditions are verified to allow polling section.

**Condition1:**When a poll worker confirms that the voter is registered, login the website ,type voter ID no and password correct means go to next state, answer to polling question ,this answer correct means go to next state finger print matched to database , matched means this person valid to next condition otherwise automatically closed web site.

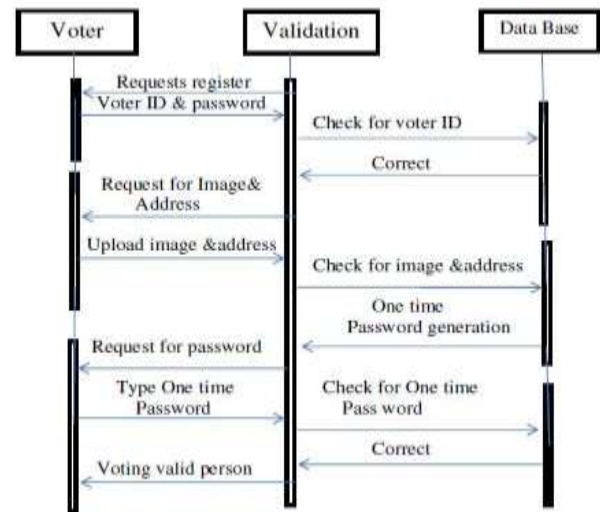


Fig.8 Authentication Sequence Diagram

**Condition2:** Randomly generated to one time password will be automatically sending through SMS to the authorized person's mobile device using GSM. Then authorized person type to password, if password correct means open the polling window then entered.



Fig.9. Polling Sequence Diagram

## VIISCREEN SHORT RESULT



Fig.10 Admin Login



Fig.13 Voter Candidate Registration



Fig.11 Users Registration



Fig.14. User ID Verification

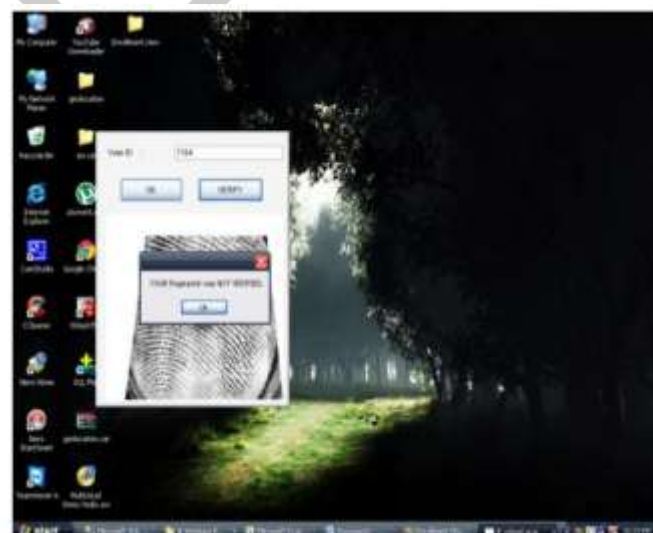




Fig.12 User Finger Print Enrollment

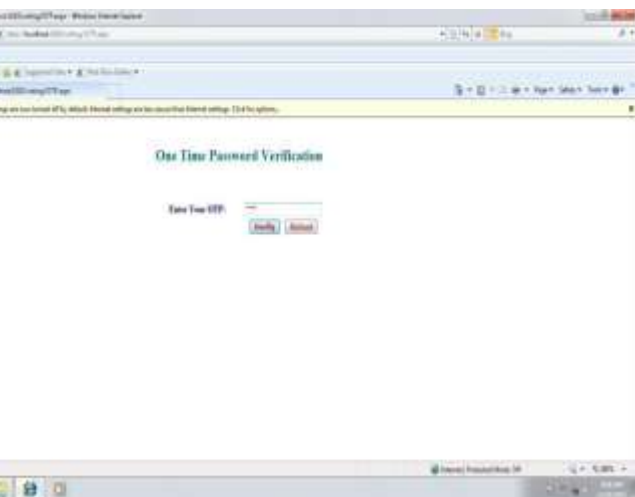


Fig.16 One Time Password



Fig.17 Online E-Voting Page

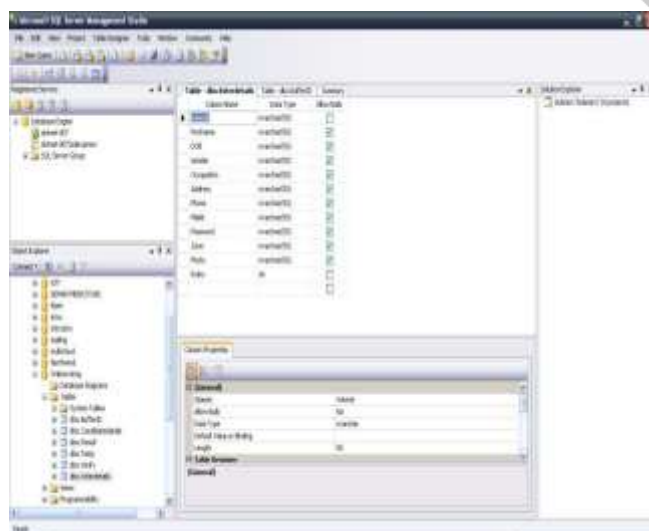


Fig.15. Finger Print Verification

## VIII CONCLUSION AND FUTURE ENHANCEMENT

Electronic voting systems have many advantages over the traditional way of voting. Some of these advantages are lesser cost, faster tabulation of results, improved accessibility, greater accuracy, and lower risk of human and mechanical errors. It is very difficult to design ideal e-voting system which can allow security and privacy on the high level with no compromise. Future enhancements focused to design a system which can be easy to use and will provide security and privacy of votes on acceptable level by concentrating the authentication and processing section. In case of online e-voting some authentication parameters like facial recognition, In case of offline e-voting some authentication parameters like, Finger Vein and iris matching detection can be done.

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Fig.18 SQL Database User Tables



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