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SMART ELECTRONIC VOTING MACHINE

Sathish Kumar .M
Dept of Electronic Communication and Engineering, Sri Muthukumaran Institute of Technology Chennai, India.
Email: Sathishkumaryk@gmail.com

Gokul Ajay .MS
Dept of Electronic Communication and Engineering, Sri Muthukumaran Institute of Technology, Chennai, India.
Email: Gokulajayms07@gmail.com

Vijay S.P
Dept of Electronic Communication and Engineering, Sri Muthukumaran Institute of Technology, Chennai, India
Email: Vijaysivaramansp@gmail.com

Ramadoss.R
Assistant Professor, Department of ECE, Sri Muthukumaran Institute of Technology, Chennai, India.
Email: ramadossapece@gmail.com

Abstract-- Elections casts an ennobling influence on the minds of people and forms the prominent feature of our country-India, in which every individual participates vigilantly and the populace remains the sovereign power. This project proposes an innovative idea that aims to construct an electronic voting machine with internet connection capability that would enable voters to cast their vote from anywhere on the planet called remote voting process. The device has biometric sensor to verify the voter's integrity that leads to a much more secured local voting process than the existing one. In addition to this, the device comes with capacitive touch keys and mp3 quality audio to aid visually impaired or illiterate people to cast their vote independently.

Keywords—Fingerprint,Capacitive touch key and Ethernet Transciever

1. INTRODUCTION

In 1980, M.B. Haneefa invented the first Indian voting machine, gazette "Electronically operated vote counting machine" His original design was exhibited to the public in Government Exhibitions held in six cities across Tamil Nadu. The EVMs were commissioned in 1989 by Election Commission of India in collaboration with Electronics Corporation of India Limited. The Industrial design of the EVM`s were faculty members at the Industrial Design Centre, IIT Bombay The EVMs were first used in 1982 in the by-election to North Paravur Assembly Constituency in Kerala for a limited number of polling stations. Electronic Voting Machines ("EVM") are being used in Indian General and State Elections to implement electronic voting in part from 1999 elections and in total since 2004 elections. The EVMs reduce the time in both casting a vote and declaring the results compared to the old paper ballot system. There were earlier claims regarding EVM's tamparability and security

which have not been proved. After rulings of Delhi High Court, Supreme Court and demands from various political parties, Election Commission decided to introduce EVMs with Voter-verified paper audit trail (VVPAT) system The Voter-verified paper audit trail (VVPAT) system was introduced in 8 of 543 parliamentary constituencies as a pilot project in Indian general election, 2014.

1.1 Traditional Voting Process

Traditional voting process can be divided into different phases

1. Authentication: In this phase, voter authenticates himself or herself by showing his or her voting card, this step is public and verified by the presiding officer. At the end of authentication process, presiding officer give a ballot paper to voter to cast his or her vote.
2. Vote: The vote takes place in a protected booth where voter cannot be seen by any person. The voter cast their vote by writing it with a pen on the paper ballot, folds the ballot paper and put into the ballot box where all the votes are mixed.
3. Vote counting: At the end of voting time, the presiding officer collect the ballot box containing all ballot papers and submit it to the counting centre. After that with the help of members of the election committee nominated by election commission of India, the ballot boxes are opened and votes are counted and the results are then announced.
4. Verification: Various types of verification process are used, most procedure are public and verified by the representative of candidates of competing parties. Recount is also possible if there is any fraud or error.

1.2 Requirement of E-Voting

The requirement in traditional voting process is also applicable for e-voting and some of them are mentioned below

1. Fairness: No person can learn the voting outcomes before the tally.
2. Eligibility: Only eligible voters are allowed to cast their vote.
3. Uniqueness: No voter is allowed to cast their vote more than once.
4. Privacy: No person can access the information about the voters vote.
5. Accuracy: All the valid votes should be counted correctly.
6. Efficiency: The counting of votes can be performed within a minimum amount of time.

1.3 Types of E-Voting

The types of E-voting are

1.3.1 Punch-card voting systems

With punch-card voting systems, the ballot is a card (or cards) and the voters punch holes in it (with a supplied punch device) next to their candidate or choice. After punching the hole(s), the voter may place the ballot in a ballot box, or the voter may feed the ballot into an electronic vote tabulating device at the voting place.

1.3.2 Optical Scan Systems:

These systems use an optical scanner to read and count marked ballot papers. Various systems can be defined as optical scan (voting) systems including

1. **Marksense systems** whereby an optical mark (e.g. made with a graphite pencil on the ballot paper) can be recognized by a scanner
2. **Electronic Ballot Markers (EBM)** that can be used to fill out optical scan ballots. The systems look like traditional DREs, but they record votes on paper ballots instead of internal memory. EBM can aid a disabled voter in marking a paper ballot; it can allow for audio interfaces
3. **Digital Pen***:* these systems use ballots on digital paper. A small camera in the pen is able to recognize where the voter marks the digital ballot paper. The ballots are collected in the polling station and the digital pen has to be returned to the elections staff for tabulation.The big advantage is that the counting process can be done in a central place and that the counting is much faster .The system is easily understandable by voter. It also allow for manual recounts of ballots.
4. **Direct recording electronic voting machine:** The device started to be massively used in 1996, in Brazil, where 100% of the elections voting system is carried out using machines. A **direct-recording electronic** (DRE) voting machine records votes by means of a ballot display provided with mechanical or electro-optical components that can be activated by the voter that processes data by means of a computer program; and that records voting data and ballot images in memory components.

1.3.3 Voter-verified paper audit trail

A voter-verified paper audit trail (VVPAT) or verified paper record (VPR) is not an e-voting system itself, but refers to a component that can be combined with various forms of non-document ballot voting systems. VVPAT means that a paper ballot for each vote is printed by the electronic device that was used to cast the vote. A VVPAT is intended as an independent verification system for voting machines designed to allow voters to verify that their vote was cast correctly, to detect possible election fraud or malfunction, and to provide a means to audit the stored electronic results.

1.3.4 Internet voting

Internet voting refers to the use of the Internet to cast and/or transmit the vote. It depends on Remote internet voting and polling site voting. In Remote internet voting ,voters can cast their vote at practically any place. The vote is then transmitted over the Internet .The other options (polling site Internet voting or kiosk voting) refer to systems where voters cast their ballot from client machines that are physically situated in official polling stations or in public places that are controlled by election officials.

2.PROPOSED SYSTEM

2.1. Internet Connected Biometric Voting Machine with Split Architecture:

This project is proposed by ST Microelectronics STM32F429 microcontroller that serves the web pages using which the voter does remote voting. The user must enter a unique ID and password before accessing the remote voting web page. Web server is responsible for serving the web pages, servicing the client request and for maintaining the TCP/IP connection until the voting process gets completed. Web pages are constructed with HTML language. The

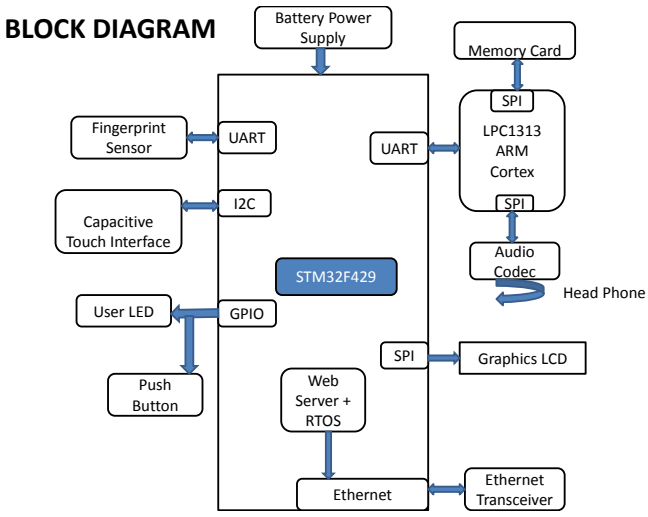
device uses the LwIP open source TCP/IP protocol stack for its internet connectivity and HTTP protocol at the application layer.

The machine has an integrated Fingerprint sensor module to verify the voter's identity. Capacitive touch keys replace the traditional mechanical buttons and a Cap-Touch controller is used to sense user press events on these keys. A Graphics display shows the menu with different party names and symbols and helps the user to select the preferred candidate.

Visually impaired people get the feedback through an audible voice. An MP3 audio codec chip is used to play the stored audio files on the memory card. A FAT-32 formatted microSD card (2GB) is used to store the audio tracks in MP3 format. The audio playback is controlled by LPC1313, a separate microcontroller dedicated for that process. Both the microcontrollers communicate via an onboard serial link based on UART.

A real time operating system is necessary to handle the timely events and other multitasking requirements of the project. FreeRTOS provides this multitasking ability for our project. It is chosen because; FreeRTOS is the number one real time operating system in the world.

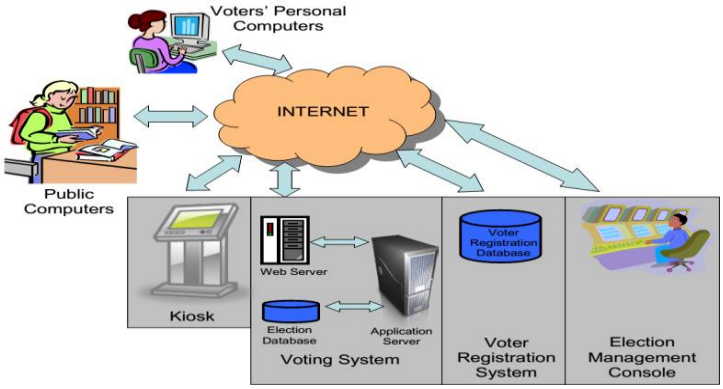
In theory, any device with a web browser can be used to cast the vote. In that case, there is low degree of control and least amount of security. Hence we suggest that the remote voting can be carried out on a secured polling booth with an internet connected kiosk terminal in which a voter will be allowed only after verified by an authorized election commission personnel. Having said this, by adding end-to-end security in the mobile app, and on the machine, remote voting is possible and can be done at the comfort zone of the voter, from any internet connected computers or mobile devices.



Indian scenario

- Remote voting through post
- Digital India Initiative for Transforming to digital
- 80 crores plus mobile phones : Excellent mobile penetration
- 86 crores plus Indians have Aadhar ID Number.

- 20 % of India population uses Internet
- Expected to grow in next five years due to programs like Digital India, National Optical Fiber Network, Etc
- Gujarat has already started providing online voting facility
- Since penetration of Internet and mobiles are increasing , Internet voting can be better option.



2.2 Fingerprint module

KY-M6 Fingerprint Sensor Module is able to conduct fingerprint image processing, template generation, template matching, fingerprint searching, template storage, etc. It following features:

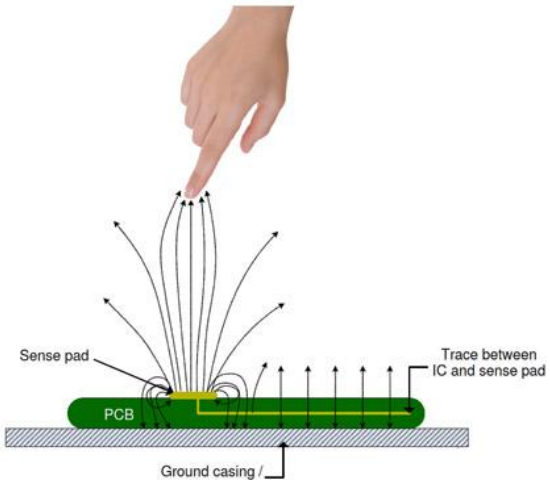
1. Proprietary Intellectual Property:Optic fingerprint enrollment device, KY-M6 hardware as well as fingerprint algorithm are all developed by KeyPower Security.
2. Wide Application Range of Fingerprints with Different Quality:Self-adaptive parameter adjustment mechanism is used in the course of fingerprint enrollment. This ensures good image quality for even dry or wet fingers, thus it has wider application range.
3. Immense Improved Algorithm:KY-M6 Fingerprint algorithm is specially written according to optic imaging theory. The algorithm is good for low-quality fingers due to its excellent correction and tolerance features.
4. Flexible Application:User can easily set KY-M6 Module to different working modes depending on complexity of application systems. User can conduct secondary development with high efficiency and reliability.
5. Easy to Use and Expand:It is not necessary for user to have professional knowledge in the field of fingerprint verification. User can develop powerful fingerprint verification application systems with the command set provided by KY-M6
6. Low Power Consumption: Sleep/awake control interface makes KY-M6 suitable for occasions that require low power consumption.
7. Different Security Levels: User can set different security level according to different application environment.

2.3 Capacitive Touch Keypad Sensor

In this type of keyboard, pressing the key changes the capacitance of a pattern of capacitor pads. Unlike "dome switch" keyboards, the pattern consists of two D-shaped capacitor pads for each switch, printed on a printed circuit board (PC board) and covered by a thin, insulating film of solder mask which plays the role of a dielectric. The mechanism of capacitive switches is very simple, compared to mechanical ones. Its movable part is ended with a flat foam element (of dimensions near to a tablet of Aspirin) finished with aluminium foil below. The opposite side of the switch is a PC board with the capacitor pads.

When a key is pressed, the foil tightly clings to the surface of the PC board, forming a daisy chain of two capacitors between contact pads and itself separated with thin soldermask, and thus "shorting" the contact pads with an easily detectable drop of capacitive reactance between them. Usually this permits a pulse or pulse train to be sensed. The keys do not need to be fully pressed to be fired on, which enables some typists to work faster.

As of 2008 they are a rare find in generic PC keyboards[citation needed]. Only vintage PCs are equipped with this type of keyboard. There are also industrial makes of capacitive keyboards that are inexpensive, and they resist wear, water, foreign objects and dirt.



2.4 Ethernet Transceiver

Ethernet is a local area technology, with networks traditionally operating within a single building, connecting devices in close proximity. At most, Ethernet devices could have only a few hundred meters of cable between them, making it impractical to connect geographically dispersed locations. Modern advancements have increased these distances considerably, allowing Ethernet networks to span tens of kilometers.

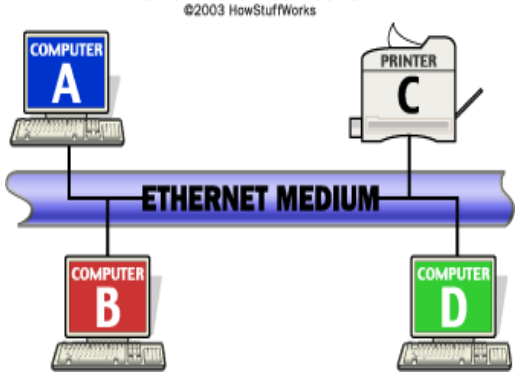
2.4.1 Protocols

In networking, the term protocol refers to a set of rules that govern communications. Protocols are to computers what language is to humans. Since this article is in English, to understand it you must be able to read English. Similarly, for two devices on a network to successfully communicate, they must both understand the same protocols.

2.4.2 Ethernet terminology

Ethernet follows a simple set of rules that govern its basic operation. To better understand these rules, it is important to understand the basics of Ethernet terminology.

- Medium - Ethernet devices attach to a common medium that provides a path along which the electronic signals will travel. Historically, this medium has been coaxial copper cable, but today it is more commonly a twisted pair or fiber optic cabling.
- Segment - We refer to a single shared medium as an Ethernet segment.



- Node - Devices that attach to that segment are stations or nodes.
- Frame - The nodes communicate in short messages called frames, which are variably sized chunks of information.

The Ethernet protocol specifies a set of rules for constructing frames. There are explicit minimum and maximum lengths for frames, and a set of required pieces of information that must appear in the frame. Each frame must include, for example, both a destination address and a source address, which identify the recipient and the sender of the message. The address uniquely identifies the node, just as a name identifies a particular person. No two Ethernet devices should ever have the same address.

2.4.3 Ethernet Medium

Since a signal on the Ethernet medium reaches every attached node, the destination address is critical to identify the intended recipient of the frame.

For example, in the figure above, when computer B transmits to printer C, computers A and D will still receive and examine the frame. However, when a station first receives a frame, it checks the destination address to see if the frame is intended for itself. If it is not, the station discards the frame without even examining its contents.
One interesting thing about Ethernet addressing is the implementation of a broadcast address. A frame with a destination address equal to the broadcast address is intended for every node on the network, and every node will both receive and process this type of frame.

2.4.4 CSMA/CD

Carrier sense multiple access with collision detection (**CSMA/CD**) is a media access control method used most notably in early Ethernet technology for local area networking. It uses a carrier sensing scheme in which a transmitting station detects collisions by sensing transmissions from other stations while transmitting a frame. When this collision condition is detected, the station stops transmitting that frame, transmits a jam signal, and then waits for a random time interval before trying to resend the frame.

CSMA/CD is a modification of pure carrier sense multiple access (CSMA). CSMA/CD is used to improve CSMA performance by terminating transmission as soon as a collision is detected, thus shortening the time required before a retry can be attempted.

2.4.5 Collision Detector

The following procedure is used to resolve a detected collision. The procedure is complete when retransmission is initiated or the retransmission is aborted due to numerous collisions.

1. Continue transmission (with a jam signal instead of frame header/data/CRC) until minimum packet time is reached to ensure that all receivers detect the collision.

2. Increment retransmission counter.
3. Was the maximum number of transmission attempts reached? If so, abort transmission.
4. Calculate and wait the random backoff period based on number of collisions.
5. Re-enter main procedure at stage 1.

2.4.6 Limitations Of Ethernet

Engineers have developed a number of network devices that alleviate these difficulties. Many of these devices are not specific to Ethernet, but play roles in other network technologies as well.

A single shared cable can serve as the basis for a complete Ethernet network, which is what we discussed above. However, there are practical limits to the size of our Ethernet network in this case. A primary concern is the length of the shared cable.

Electrical signals propagate along a cable very quickly, but they weaken as they travel, and electrical interference from neighbouring devices can scramble the signal. A network cable must be short enough that devices at opposite ends can receive each other's signals clearly and with minimal delay. This places a distance limitation on the maximum separation between two devices on an Ethernet network. Additionally, since in CSMA/CD only a single device can transmit at a given time, there are practical limits to the number of devices that can coexist in a single network. Attach too many devices to one shared segment and contention for the medium will increase. Every device may have to wait an inordinately long time before getting a chance to transmit it.

3. Conclusion

The current election process does not provide sufficient access for voters with impairments. Greater efforts therefore need to be made to allow them to vote independently, so as to make them less dependent on proxy voting. Thus by using IOT we achieve better than existing one.

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