BIOMETRIC BASED ELECTRONIC VOTING MACHINE

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Abstract- The aim of the project is to develop a Biometric based Electronic Voting Machine that can be used to distant voting, better authentication. The key motivation lies in simplifying the complex electoral process of India. Biometric EVM also tries to find out new methodologies to address verification of voters especially thumb impression of voter in this project. The technology also provides a secured confirmation to voters about their registered vote and addresses an issues of security and tampering of traditional EVMs the technology encourages fast counting of votes provide quick result of elections. The project uses a Raspberry Pi as a microprocessor of the technology. It uses fingerprint scanner for the verification of voters and single national database system of voters with SQL for database management. Biometric Electronic Voting Machines connected with UIDAI would provide safe, secure and swift elections in India in the near future.

Index Terms- Authentication based on fingerprint, Biometric Based EVM, Central Server Database, Electronic Voting Machine (EVM)

I. Introduction

India is the largest democracy in the world with 910 million voters and election as a complex and timing consuming exercise. The general election 2019 was carried out for over a month to elect a new union government. The Vice President of India had once said, "Technology is a great democratic tool. It is only an enabler but also equalizer, which can help a billionaire as also the poorest of the poor" [1].

The aim of the project is to develop a Biometric based Electronic Voting Machine. The system uses thumb impressions for voter identification as a fingerprint of every human being has a unique pattern. The technology directs the voter as per his registered constituency. The EVM also notifies voters about his registered vote with a message of confirmation on a registered mobile number.

The applications of this project are enormous. The biometric EVM maintains a single common database of all voters of the nation. The Unique Identification Authority of India (UIDAI) [5] already has the biometric database of all citizens in the form of Aadhar. The database can be connected with the electoral system to use in the elections. As per the study commissioned by Election Commission, 326 million voters are migrated from their home constituency [2] which makes it difficult for them to participate in elections. A 2011 study on political inclusion of seasonal migrant workers by Amrita Sharma found that 22 percent of seasonal migrant workers in India did not possess voter IDs or have their name in voting list [3]. The electoral process of democracy encourages the maximum participation of voters and this project simplifies the problem of distant voting. The biometric EVM can be used to vote for any constituency as per the requirement of the voters.

The important issue traditional electronic voting machines face is the issue of credibility. Opposition has always alleged that there are high chances of tampering EVMs [6] for the benefit of the ruling party.

This project addresses the problem by introducing new features in the technology of confirmation of voting. The biometric EVM sends confirmation messages to voters on registered mobile numbers which could be used to verify the authenticity of voting. The project addresses some of the key challenges in the electoral system of India and tries to simplify it for the citizens using simple technology.

II. PREVIOUS WORK

Automated Voting Machine (also known as EVM) uses electronic means to either support or take care of the casting and counting chores.

An EVM is composed of two units: the control unit and the ballot unit. Those units are connected by a wire. The EVM's control unit is maintained alongside the presiding officer or polling officer. The balloting machine for electors to cast their votes is kept within the voting compartment. This is done to make sure your identity is checked by the polling official. With the EVM, the polling officer will press the Ballot Button instead of issuing a ballot paper which allows the voter to cast their vote. A list of the candidates' names and/or symbols with a blue button next to it will be available on the screen. The elector can press the button next to the name of the candidate for which they wish to vote.

Biometric EVM has recently drawn the attention of many researchers. In this section the relevant works are briefly discussed on electronic voting systems with biometric authentication.

An electronic voting machine model was addressed in a study where user verification was performed using Near Field Communication (NFC) ID card and biometric technology. In this method the casting of multiple votes was limited by marking this NFC card after the user had cast his vote once. In another study conducted by Hof, the use of various biometric identifiers in e-voting and their security implications were studied. He addressed some of the drawbacks of biometric systems such as spoofing, false acceptance and rejection rates etc. and therefore recommended that biometrics be incorporated with safeguards in e-voting. In a study, an abstract voting method model was implemented in fingerprint minutiae, with fingerprint authentication and matching process information.

A Sarkar-led study gave a brief overview of the current e-voting systems and their structure and protocols. They discussed EVM's recent innovations in the Bangladesh context and suggested some strategies to improve security, the accuracy of the existing architecture. 8 In another report, Sarker suggested a conceptual design of fingerprint-authenticated electronic voting machines that helped eliminate defrauding manual voting systems and prior electronic voting models. They used a network structure of four layers with three application servers and one client to transfer data from client to database.

Khasawneh's study proposed an idea of a multifaceted online e-voting program with integrated biometric verification such as fingerprinting, facial recognition, iris scanning etc. For this model, multi-scope electronic ballot paper was implemented, and computer simulations were performed to test the robustness and accuracy.

In summary, each of the research work incorporates different ways of authenticating electronic voting systems. Although some studies show the implementation of Biometric EVM, each of them has its own use of meaning for both pros and cons. It is important to use such as NFC or Adhar card in some proposed system which introduces the problems of losing or stealing IDs. Some of the developed models did not have simple user interface and integrated database, biometric authentication, etc. like EVM which was tested in some countries-Bangladesh, India. Our contribution in this paper is therefore to introduce a conceptual design and development of Biometric EVM which is unique, secure and convenient for solving the problems raised [9].

III. PROPOSED METHOD

The method is research based on the news articles and various researches related to traditional Electronic Voting Machines. As a matured voter the researchers have experienced various flaws with the current electoral system and interviewed some of the student voters to identify the various problems undergone by them. The researchers also visited the Election Commission websites and reports to understand more about traditional EVMs.

The proposed method creates a central database of voters which can be accessible from any Biometric based Electronic Voting Machine instead of constituency or ward wise database. The model involves solutions like unique identification based voting for better authentication of voters and avoid bogus voting. The method of distance voting is introduced in the model to ensure maximum participation of voters. The SMS based vote verification system is developed to address the credibility issues questioned by political parties. The fast votes counting system is enabled to simplify the work of booth officers and avoid logistical problems faced by the Election Commission in elections.

A. Process

We have developed a user friendly interface which can help voters to understand the procedures to handle the EVM and vote should be explained simplifically. The different windows of voting interface are as follows:

a. Welcome window: The Welcome window is a simple introductory interface which will be the first to interact with voters. It has a button named "Next to Vote" in the middle.
b. Instruction window: The voting procedures mentioned as putting a finger on the scanner and waiting for the authentication, then pressing the "Next to Vote" button again.
c. Voting window: The voter details window has image, name, age, constituency and ID Number of the voter.The candidate list is the same part as traditional EVMs interface. All candidates of the constituency of voter are displayed here along with their Party and Party symbol. To choose the preferred candidate to vote, the voter can simply touch the button next to the candidate.
d. Confirmation window: The final confirmation window is a simple text window with the message 'Your vote has been registered'. When the window appears, the candidate will also get notification about his vote with the name of the party he/she voted for. This verification by voters can be used instead of VVPATs of traditional EVMs.

B. Hardware Setup

1. Raspberry Pi 3 Model B

a. Quad Core 1.2GHz Broadcom BCM2837 64bit CPU
b. 1GB RAM
c. BCM43438 wireless LAN and Bluetooth Low Energy (BLE) on board
d. 100 Base Ethernet
e. 40-pin extended GPIO
f. 4 USB 2 ports
g. 4 Pole stereo output and composite video port
h. Full size HDMI
i. CSI camera port for connecting a Raspberry Pi camera
j. DSI display port for connecting a Raspberry Pi touchscreen display
k. Micro SD port for loading your operating system and storing data
l. Upgraded switched Micro USB power source up to 2.5A

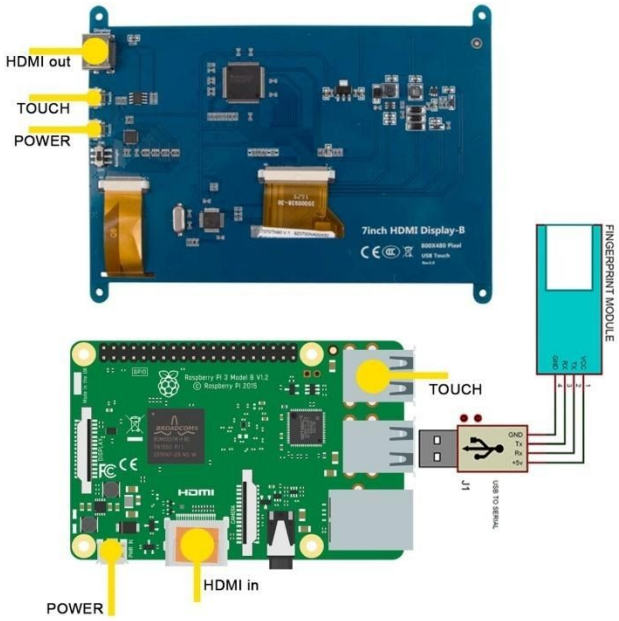
2. Fingerprint Sensor R305

a. Power DC : 3.6V-6.0V
b. Interface : UART (TTL logical level)/ USB 1.1
c. Working current : 100mA
d. Peak Current : 150mA
e. Matching Mode: 1:1 and 1:N
f. Baud rate (9600*N)bps, N=1-12 (default N=6 57600bps)
g. Character file size: 256 bytes
h. Image acquiring time : <0.5s
i. Template size : 512 bytes
j. Storage capacity: 256
k. Security level : 5 (1, 2, 3, 4, 5(highest))
l. FAR : <0.001%
m. FRR: <0.1%
n. Average searching time: < 0.8s (1:880)
o. Window dimension : 18mm*22mm

3. 7" inch LCD Touch Display

a. 800×480 high resolution.
b. Capacitive touch control.
c. Supports Raspberry Pi, and driver is provided (works with custom Raspbian directly).

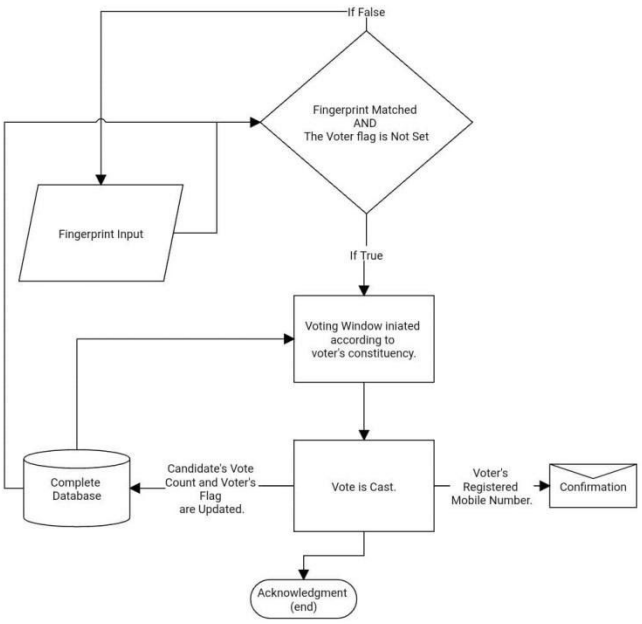
d. Supports BB Black, comes with related images like : Angstrom.
e. Supports Banana Pi / Banana Pro, comes with related images like : ubuntu, Raspbian.
f. Not only for mini-PCs, it can work as a computer monitor just like any other general HDMI screen (touch function is unavailable in this case).
g. HDMI interface for displaying, USB interface for touch control.
h. Backlight control to lower power consumption.

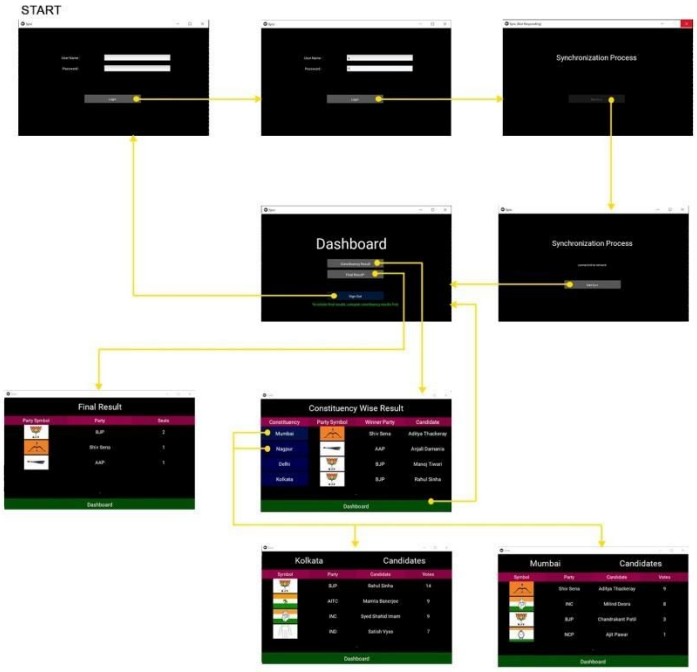


C. Counting

Counting of votes is an integral part of all the activities that are being carried out during elections. This has to be accurate, efficient and fast. By using the database management specified above counting process will be very easy, fast and at the same time reliable.

We can understand the process of vote registration from the figure below.





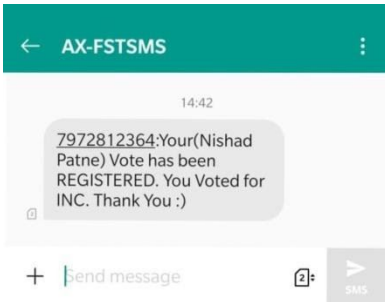
Once the voter has casted the vote there will be an increment in the vote's column of respective candidate. This process will go on till the voting process ends.

When the voting process is finished we have to access the constituency table for results. This table will retrieve data from the constituency table for candidates of the two candidates who got the maximum and number of votes, party name etc. The candidate with more votes is the winner and the other one is the trailing candidate (lost candidate). The difference between the votes will appear in the margin column. All of this data will consist of the table for all constituencies.

Thus the results can be announced accordingly.

D. SMS Verification System

The Traditional EVMs use Voter-verified paper audit trail (VVPAT) to give confirmation to voters about their voting. The Biometric based Electronic Voting Machine uses a messaging service to inform voters about their vote and party which they voted for. In this project we have used a third party system named FAST2SMS to send voter confirmation. The received message on voter's personal mobile phone is as:



Fast2SMS:

It is an API SMS service which can be used for bulk messaging. Fast2SMS expects the API Key to be included in all API requests to the server in a header for POST requests & in query parameters for GET requests.

IV. IMPROVEMENTS AND FUTURE SCOPE

The Biometric based Electronic Voting Machine tries to fulfil all the objectives throughout the project. It provides a way through to conduct safe and accurate elections. However the model has some limitations.

1. The verification of fingerprints may take some time extra than expected for the centralised database due to the huge number of voters for election.
2. The Biometric authentication of voters can be challenging for physically disabled people.
3. Performance can be fluctuating to environmental conditions, badly maintained systems, age groups, etc.
4. The Biometric identifiers of voters cannot be changed, if compromised.
5. Distance voting can lead to problems of voter's management in densely populated areas.
6. There are chances of breaching the secrecy of mobile phones of voters to learn about their voting patterns.
7. The reduction in time to vote and count can lead to administering as well as law and order issues.

These constraints can be overcome in future to make this system more trustworthy and reliable.

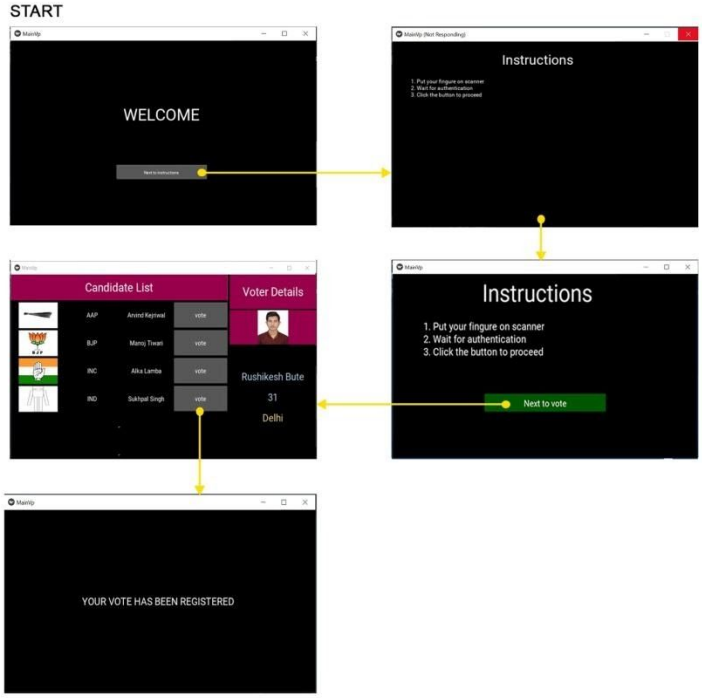
First thing can be done is, the system of authentication with fingerprint scanning can be extended to a multi-biometric system including retina scan, face recognition etc. Second, the UIDAI already has the biometric database of all Indian nationals in the form of AADHAR [5]. The biometric data can be used as a centralized voter's database and can be modified from election to elections as per requirement. The already existing data would reduce the efforts to allot voter id cards to each new voter and can directly recommend him to vote when he/she is qualified to vote by age. Third, the voting process can be shifted to Block chain Technology for better security of the elections and lowering the chances of tampering.

V. CONCLUSION

A conclusion section is not required. Although a conclusion may review the main points of the paper, do not replicate the abstract as the conclusion. A conclusion might elaborate as India is considered as the largest democracy in the world, Safe and accurate elections must take place to protect democracy in India. By using this Biometric based EVM we can ensure the most secure, safe and accurate elections. Biometric authentication makes sure that no fake votes are casted and prevents multiple voting. The centralized database used to cast distance voting and solve the participation problems of migrants in elections. The instant results lower the chances of tampering the EVMs for results and display the nationwide results on each Machine instantly when Election Day ends. This way Biometric based EVM helps to overcome the drawbacks of the current EVM system. As current EVM's integrity and accuracy is in doubt as a result of various elements in society and officials. Therefore we can say that implementation of Biometric based EVM can provide a transparent, fair, secure and accurate election process in India and thus hold strong roots of democracy in our country. on the importance of the work or suggest applications and extensions.

APPENDIX

Voting Flowchart:



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