

# Kerberos based ATM Voting System: Voting Friendly Model

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## ABSTRACT

In this paper a KBATMVS model is proposed through which, with the help of ATM, voting procedure can be performed with proper authentication irrespective to the geographic locations of voters. Authentication will be performed through some biometric recognition systems. For this voters have to pass a 2-level authentication procedure. It will not only save lots of money but also save waste of papers and security resources which are used during voting. This model will also be friendly and helpful for handicapped voters. Voter simply performs some steps and after successful voting, a voting receipt will be generated. All the ATMs will be connected through ATM network. Authentication and voting procedure will be performed with the help of authentication server of Kerberos and database of voting card issuing authority. Voters can participate in voting without relying on their respective voting areas.

## General Terms

Authentication, Security.

## Keywords

ATM Voting Card (AVC), Automatic Teller Machine (ATM), Authentication Server (AS), Kerberos, Kerberos Based ATM Voting System (KBATMVS), Voting Server (VS), Face Recognition Database (FRD), Palm Recognition database (PRD), Voice Recognition Database (VRD).

## 1. INTRODUCTION

Traditional voting systems which were based on ballot papers or ballot boxes on which name of the candidates and their allotted party symbols are printed. These ballot boxes are used for voting during elections [1]. At the end of the day these boxes are sealed and send to the counting places. At counting places these boxes are opened and all the votes counted manually. But this voting system includes lots of money, lots of resources, lots of papers and security. This system is also suffered from human errors during counting, time consuming and lack of security. To overcome these issues several models have been proposed like Electronic voting machine better known as EVM, Cell phone based E-voting, I-Voting, Post-voting in many European Countries etc. [2]. Apart from these several suggestions are also proposed to make voting system simple and friendly for disabled voters.

In this paper a KBATMVS model is proposed which uses ATM as a voting machine and Kerberos for authentication process. This model will not only save papers but also improve the level of security. This model is also useful for handicapped voters who are not able to vote. In this model all the ATMs are connected through ATM network with different

AVC issuing authorities so that electorates can vote irrespective to the geographic location.

This paper is structured as follows. The next section describes the related papers. In Section 3, requirements for a voting-friendly system are described. Working of the proposed model is described in section 4. Finally, results and conclusions are discussed.

## 2. RELATED PAPERS

First, In 1856 the paper ballot system was adopted for voting purpose. It was used firstly in the Australian state of Victoria and thereafter it named as "Australian ballot". In this different boxes are used on which each candidate name is printed. Voters use the ballot, which is a piece of paper and it is used to record someone's vote. Voters select their choices in that paper and drop that voted ballot in a ballot box which is sealed [3].

In New York in 1892 a lever type voting machine was used. It uses mechanical levers and on each lever the name of the candidate is assigned and then the voter pulls down one of the lever based on their choice [3].

In 1964, punch cards systems came into existence when it was used by Fulton and De Lalb Countries in Georgia. Voters punch holes with the help of a punch device in the cards which is opposite to their ballot issue choice [3].

In 1996, punch card systems were used by 36.3% of registered voters in the United States with some variations of the punch card. In 1996, 24.6% of registered voters in the United States used Mark sense or also known as Optical Scan system for the presidential election of US [3].

Direct Recording Electronic (DRE) voting system is the most recent configuration in the era of voting systems. They are nothing but an electronic implementation of the previously used mechanical lever system. In 1996, 7.7% of the registered voters used DRE voting system in the United States [3].

In 2004, for general elections Secure Electronic Registration and Voting Experiment (SERVE) voting system is planned for deployment. For this, the eligible voters first to register for voting in their districts of home and then to vote. It can be done electronically via the Internet. It can be used from anywhere in the world. It is an Internet and PC based system. But it suffered from lots of security problems and attacks and many experts of security suggested that SERVE system should be closed [4].

In 1980s, the first Indian Electronic Voting Machines or better known as EVMs were developed in 1980s by Electronic

Corporation of India (ECIL). In July 2009, According to Statistics of Election Commission, there were 1,378,352 EVMs in use [5].

But it also suffered from so many security issues like Criminals or dishonest election insiders can alter the election by replacing a small part of the machine with a look-alike part that can be instructed wirelessly through a mobile phone and can steal a percentage of the votes and transfer in the favour of a selected candidate. Another attack, which uses a device in the shape of a size like pocket to alter the votes which are stored in the memory of EVM during the election and the counting session [6]. For enhancing the security several models have been proposed like Secure e-Voting system based on Biometric recognition[7], Electronic voting through ID based Signature scheme[8], An efficient electronic election system based on RSA algorithm[9] etc.

Apart from normal voters there are also many handicapped voters who are not able to vote through these voting systems. According to one report of DNA agency in India, Maharashtra's vision is to make the EVM system easy for the disabled so that they can also participate in voting without any difficulties. For this, government have planned to provide facilities like ramps or mobile staircase, polling booths on ground floors to make the system easier and simple for the disabled people [10].

During elections to prevent electoral fraud, election ink or phosphoric ink or dye is used. It is applied to the forefinger of voters to prevent from double voting. But there are so many controversies in different countries related to this election ink. It can be easily erased or washed off with the help of some chemicals and electoral fraud can occur [11]. Because of many security and authentication issues still there are so many studies and researches are going on to make the system reliable, secure, accurate, efficient, simple and voting-friendly.

### 3. REQUIREMENTS FOR A VOTING FRIENDLY SYSTEM

There are following requirement for a voting friendly system.

- 1) Proper authentication of voters who are participating for voting.
- 2) Saving of papers which are used during voting procedure.
- 3) To make the voting system easy and simple for disabled voters.
- 4) A voting system which doesn't depend on geographic locations of voters.
- 5) Requirement of voting receipts so that voting can be confirmed by the voters after voting procedure.
- 6) Can save the human resources in terms of security guards, government employees and money, means of transportation used for carrying EVMs, voting employees during elections.
- 7) Can provide accuracy during counting of votes.

### 4. THE PROPOSED VOTING SYSTEM

In this paper a voting system named KBATMVS is proposed. In this section construction concept and working procedure is described. Working procedure is performed in three phases: Verification stage, Voting stage and Completion stage. These three stages of proposed model are described in later section one by one.

### 4.1 Construction Concept

To implement this model with the existing ATM components, face recognizer, palm recognizer and a voice recognizer devices are needed, which is shown in figure 1. An ATM is a real-time front terminal through which ATM users' access automatic teller services. It works with the help of central bank server and a centralized account database [12]. For accessing ATM services a plastic ATM card with a magnetic strip is used. This magnetic strip or chip contains a unique card number and along with this number it also contains some security related information like CVV number, an expiration date and issuing date etc. [13]. Apart from these details this chip will also contain the information about handicapped voter especially for blind voters, in the form of symbols like 'B' for Blind voters. Whenever the card reader will read these symbols the ATM machine will work based on handicapped type like in case of blind voters the ATM touch screen will activate its Braille touch screen [14] or voting procedure can also be performed with the help of voice recognizer device and speaker. ATM will provide audible instructions so that voters who are not able to read can vote by following the instructions of machine and vote with their voice. Voice recognizer will recognize the voter's voice and perform the voting procedure according to the options given by voters. The height of ATM should be in such a manner so that voter who is using wheelchair, can easily access the ATM screen.

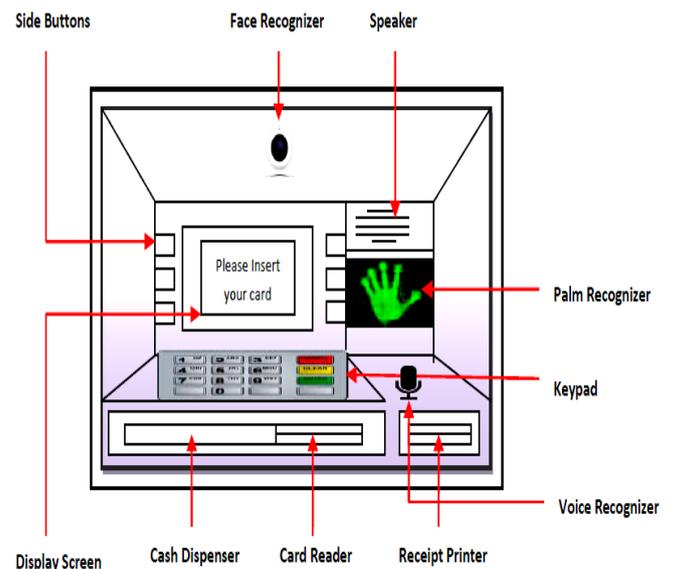


Fig 1: Basic Model Representation

In proposed model a separate ATM voting card is used, because if an ATM card will be used then it can only be access by those people who are banking users and still a large population of world not having bank accounts. So for this reason a concept of ATM voting card (AVC) is used which will also look alike ATM card but whenever voter will insert this card he/she will be connected for voting services not for banking services. These services through ATM will be activated during elections only.

An ATM works with the help of a host processor, which is analogous to an Internet Service Provider (ISP) in that various ATM networks become available with the help of gateway. These host processors can support either dial-up or leased-line machines. Whenever a card holder inserts the ATM card the card reader reads the unique card number and other details

and asks for a secret pin for authentication purpose. After getting these details ATM forwards this to host processor which routes the request to the cardholder's issuing authority or bank then the transaction takes place [13] as shown in figure 2.

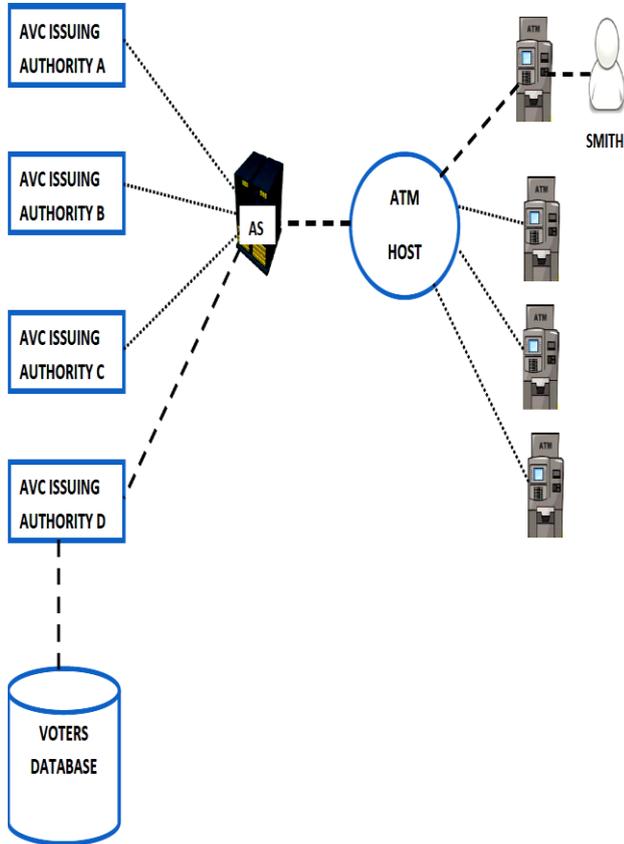


Fig 2: Proposed Architecture

In this model Kerberos is used for authentication purpose, which will be used during verification of voters common details and verification of their biometric recognition like its other applications which are used in reference [15] and [16] proposed models. With the help of ATMs, voters can vote without depending on their voting areas and they can go to their nearest ATM for voting purpose.

#### 4.2 Verification Stage

The voter, who wants to take participate in voting will go to his/her nearest ATM. For example purpose voter name smith is used to explain whole procedure of verification and voting. In all the ATMs voting service will be activated at the voting period only. Smith will use his ATM voting card (AVC) to participate in voting process. This AVC will be issued by AVC issuing authorities or respective country's government. Whenever smith will insert AVC into ATM. Then first ATM will identify the handicapped status of corresponding voter if it is 'B' then it will provide the services which can help to the blind voter otherwise it will work normally. After getting the AVC unique number and other security details of smith it will send all these information in encrypted form to AS with the help of ATM host processor as shown in figure 3. In ATM such encryptions are performed by 3-DES algorithm.

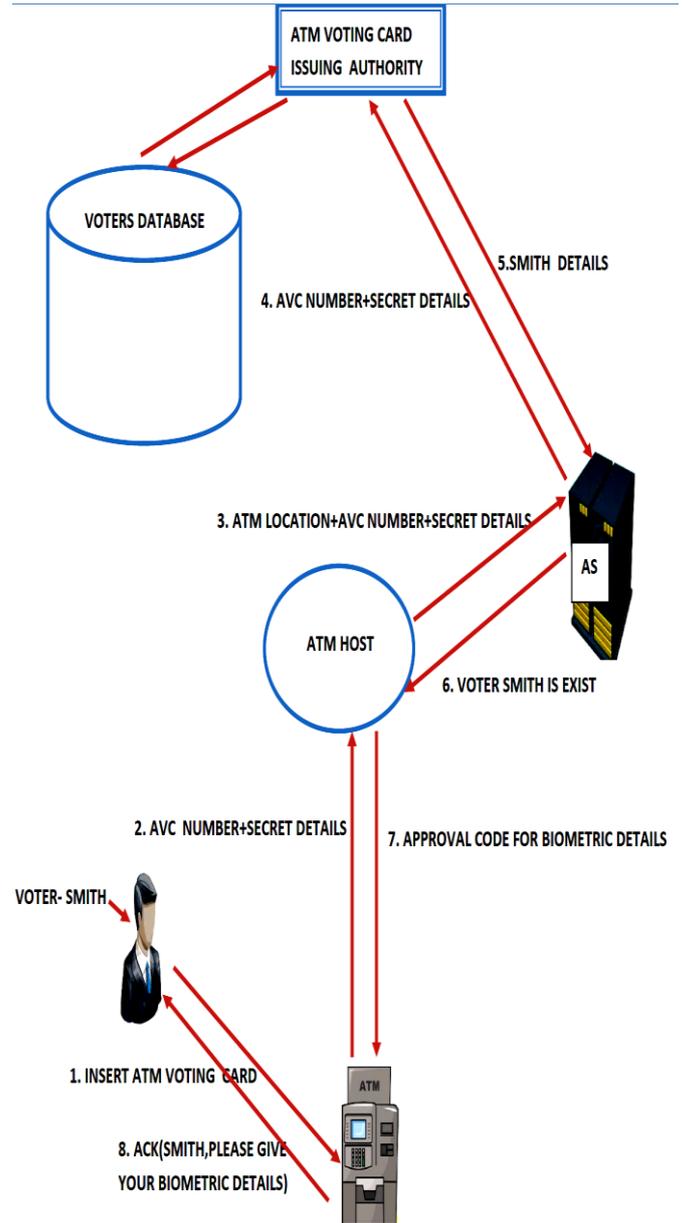
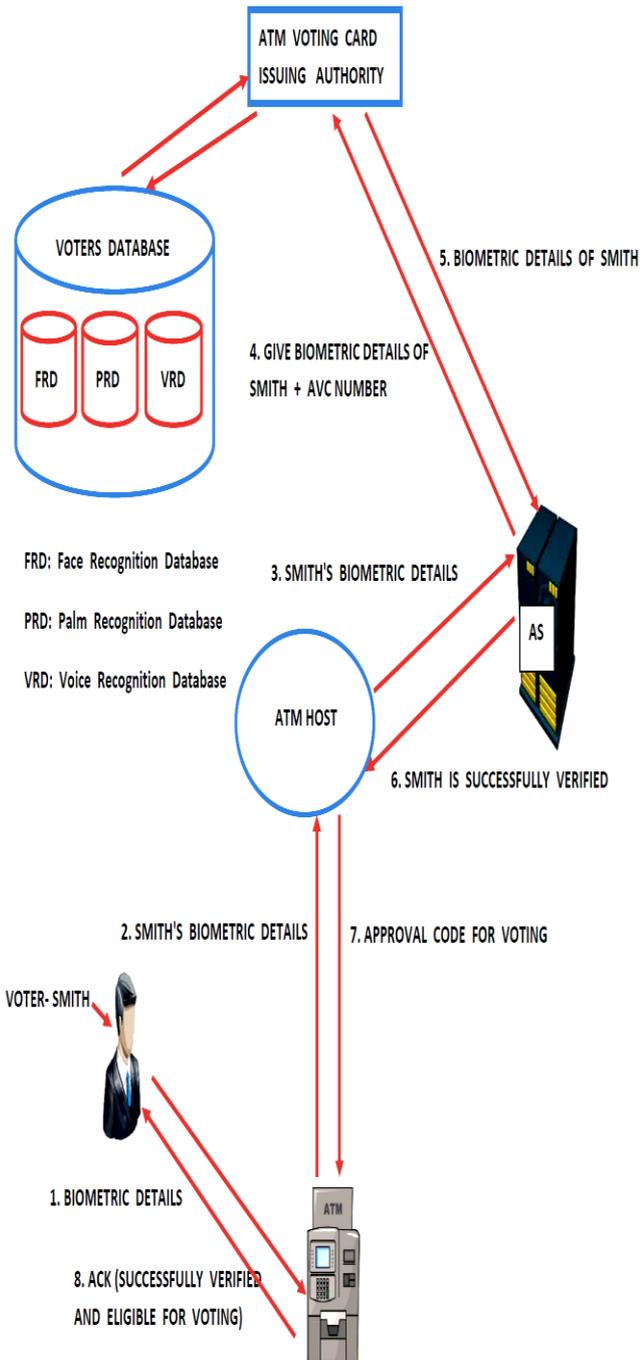


Fig 3: Verification for Voter Existence

AS will also receive the ATM location. Now AS will send these details to AVC issuing authority of voter smith. AVC issuing authority will retrieve all the common details such as name, fathers name, date of birth, address, mobile number etc. about smith and it will also check that smith is already voted or not and send these detail to AS. After getting the existence of smith AS will send an ACK related to existence of smith to ATM Host. After getting the approval code for biometric recognitions ATM will ask for face and palm details of smith.



**Fig 4: Biometric Verification**

When the face and palm details of smith are taken successfully by ATM machine. Then ATM machine will send these biometric details to AS with the help of ATM host in encrypted form. After getting the biometric details of smith, AS will decrypt it and again ask to AVC issuing authority of smith for stored biometric details of smith. To know about stored biometric details of smith AS will use AVC unique number of smith. AVC issuing authority will retrieve the biometric details from voters database and send these to AS. AS will match that both biometric details send from AVC issuing authority and ATM Host are matching successfully or not and verify whether smith is eligible to participate in voting or not and will send the acknowledgement (ACK) to the ATM host processor. Now ATM host processor will check whether

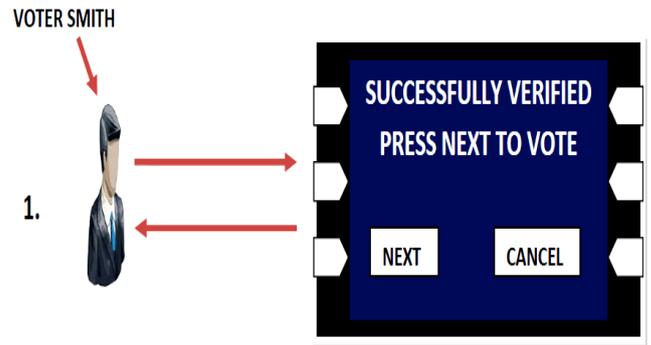
smith is successfully verified or not if successfully verified then it will send an approval code for voting to the corresponding ATM machine. Then smith will get a message in his ATM screen that "you are successfully verified and eligible for voting" as shown in figure 4.

In the case of false matching ATM will display that which kinds of details are not matched.

**4.3 Voting Stage**

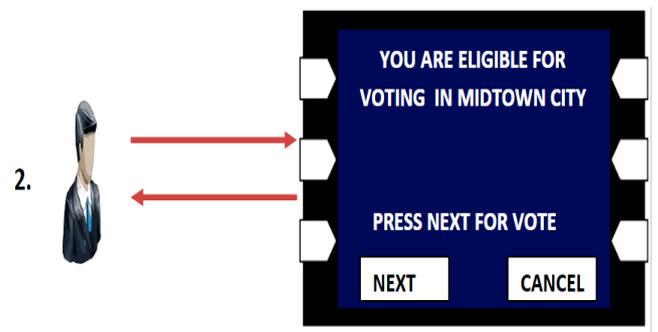
For voting following steps will be performed-

Step-1 After successful verification voter smith has to press next to vote.



**Fig 5: Step 1 of Voting Stage**

Step-2 Voting server will process the request and display details about voting area of smith in which smith is able to participate for voting. Voter smith can either press next for vote or smith can exit from voting procedure through cancel button.



**Fig 6: Step 2 of Voting Stage**

Step-3 A list of candidate names with their corresponding voting symbols will be displayed. Voter smith has to select his choice by either through touch screen or by pressing numbers.

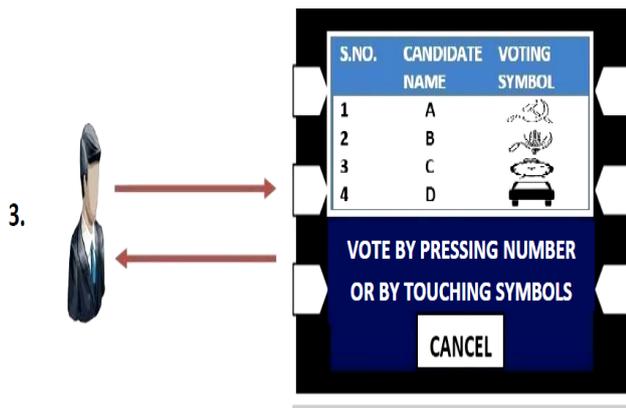


Fig 7: Step 3 of Voting Stage

Step-4 After selecting candidate choice, again it will ask for confirmation about selected candidate. Voter smith can either confirm his vote or he can go back through back option and can change his candidate choice.

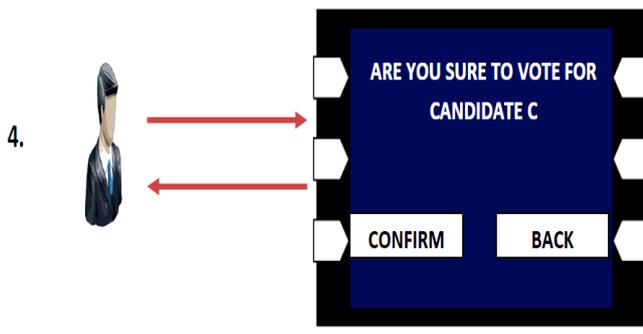


Fig 8: Step 4 of Voting Stage

Step-5 After confirmation of vote a message will be displayed on screen that you are successfully submitted and then voting server will record the vote of that voter. If smith is already voted then it will display a message that you are already voted.

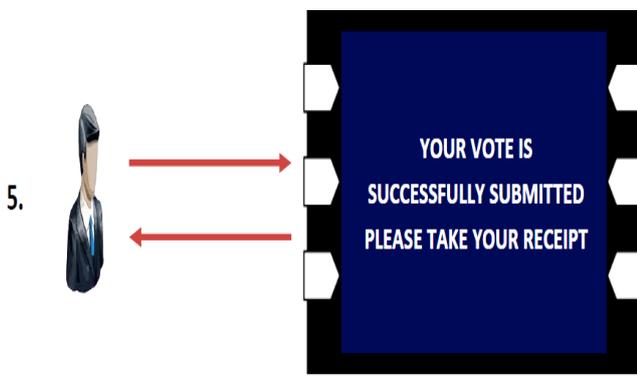


Fig 9: Step 5 of Voting Stage

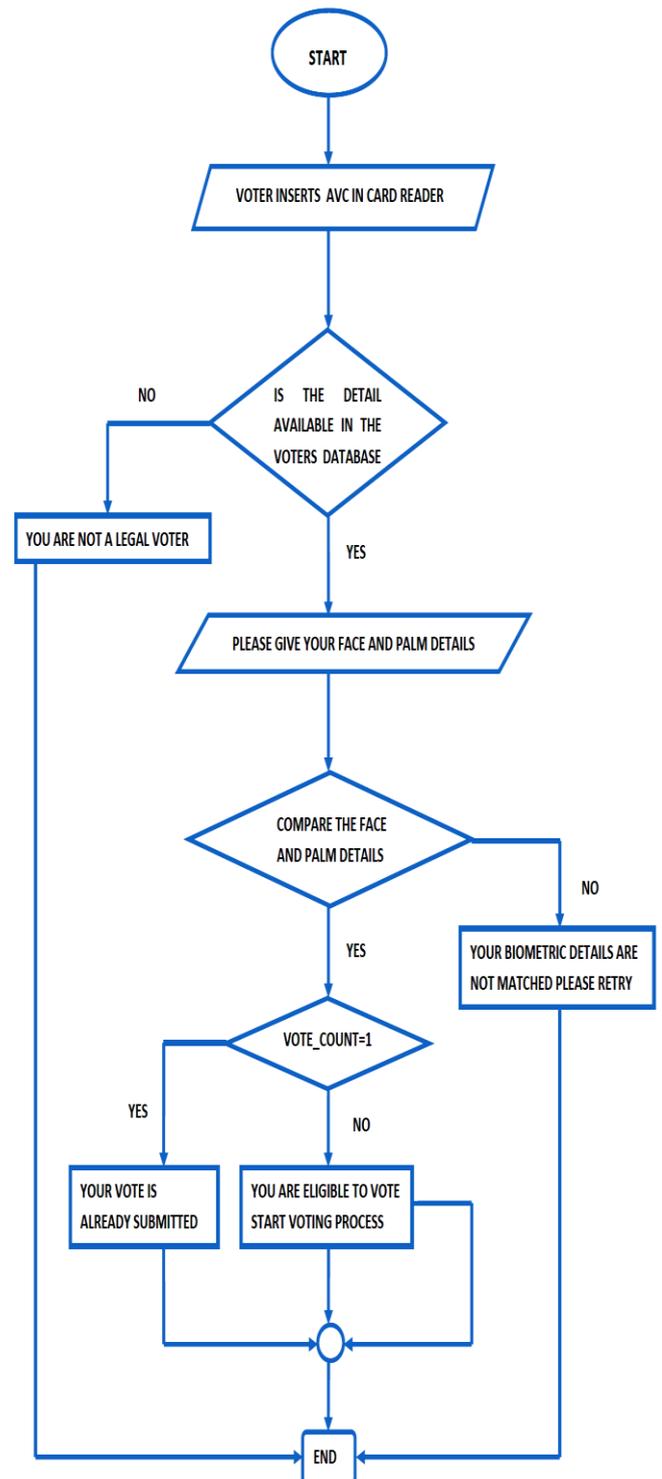


Fig 10: Verification Stage Flow Chart

#### 4.4 Completion Stage

After successful voting smith will get a voting receipt in which the details about voting confirmation will be given. This will also be sent in the form of message to the mobile number of smith. Whole procedure is also shown with the help of flow charts in figure 10, 11 and 12.

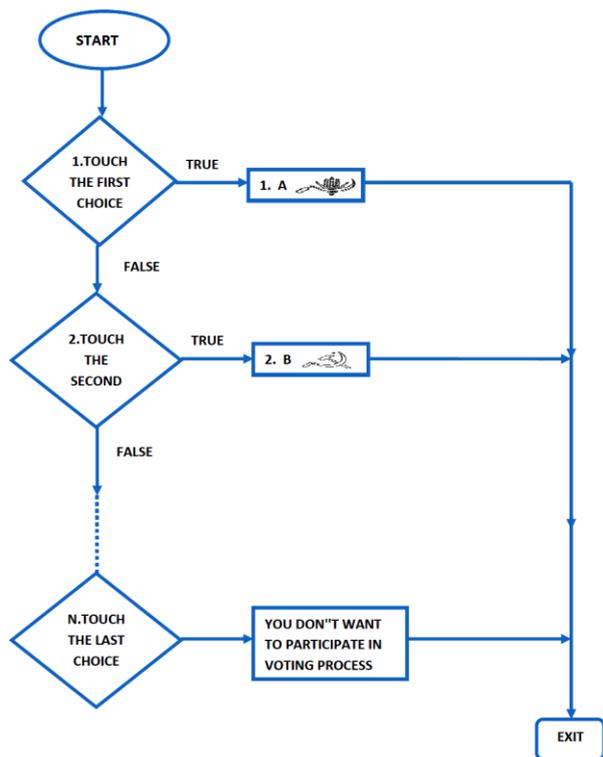


Fig 11: Voting Stage Flow Chart

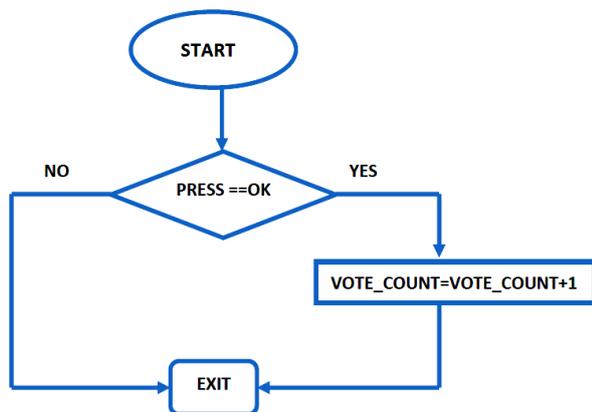


Fig 12: Vote Count Process Flow Chart

## 5. CONCLUSIONS

In this paper a framework of Kerberos with ATM is proposed which can handle all earlier issues of conventional voting systems. This model provides a secure way of voting. Voters can give their vote without depending on their voting areas. Biometric recognition systems will provide a secure way of authentication. This model will provide an easy way of voting and the disabled voters can easily access this system. Blind voters can either use Braille or voice recognition system for voting. After successful voting a confirmation receipt will be generated.

This model will encourage those voters who don't want to visit voting centers. This model will increase the voting proportion because people are habitual of visiting ATMs for their day to day transactions. In traditional voting systems disabled voters were not able to participate because of their complexities. But in this proposed system they will be able to

participate because of its voting friendly nature. This model will provide accuracy in vote counts and security from external attackers so that there will be no alteration in election results.

In future two important issues that are needed to be resolved- scalability and availability. As many security firms are trying to improve authentication in ATMs by using some biometric recognition techniques so scalability is not a big issue. Many banks have declared that they are going to increase number of ATMs in different regions like villages and usually voting is conducted into several phases so availability of ATM will also be not a big problem. To conduct elections through ATM will require less number of security guards, less number of government employees and less money. Such type of elections will not affect any transportation or any kind of business which is usually stopped during the election period.

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