Design and Implementation of a Secured Mobile Voting System (SMVS)

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Abstract. - Elections are understood to be the key mainstay of democracy all over the globe and voting is one of the electoral routes that ensure the sustenance of democratic system in any civilization. Voting is the process that allows the general public or the people to choose their leaders and articulate views on how they will be governed. SMVS is developed to enhance the conduct of free, fair, reliable and acceptable election. The system was design using Android studio, Java and Php programming language, Mysql was used for the design of the database. It consists of two major modules; server module and mobile module. The mobile module is installed on the mobile phone which gives electorate the ability to log in to the server module through the use of matriculation number and password and submitting votes. The system was implemented on the WAMP server and later hosted on the internet to test its efficiency and workability. During the implementation the voters were able to cast their votes by logging-in with matric number and password. Various output were generated by the system which includes election results, registered voters list and aspirants list.

Keywords: Voters, Mobile, Result, Server and Authentication.

1.0   Introduction

The electoral system is paramount to the survival of democracy all over the world. Current happenings around the world, particularly in the developing world where poor conduct of elections had left a number of countries devastated are of great concern to world leaders (Charles, Daramola, Azeta, 2011). Students' participation in the political process is essential for democracy to be meaningful and feasible. Voting, though it requires little initiative and cooperation with voters, is the most critical and a widespread form of students' involvement. The veracity of democratic system is primary to the veracity of election itself consequently the election system must be satisfactorily secured to survive a range of fraudulent behaviours and must be sufficiently translucent and comprehensible that voters and candidates can accept the outcome of an election. Unsurprisingly, history is littered with examples of elections being manoeuvred in order to change their outcome (Shafi'i, Olawale, Damian and Mohammed, 2013)

 Many parts of Nigeria have experienced setbacks, which have led to the destruction of both lives and property, simply because the rule of the game was not adhered to, and so political violence, unhealthy politicking have been the order of the day. People usually wanting to impose themselves on the voters, so they use all sorts of means to get into office. And this has continued to cause a lot of harm and has made the citizens poorer in spite of the abundance of natural and human resources in the country (Shafi'i et. al., 2013)

 Traditional voting process is fully manual and paper based which was very time consuming and prone to security. As technology developed, electronic based voting systems were still prone to electoral frauds and voters have to make tremendous efforts in order to cast their ballots. The proposed system is secure mobile voting which will overcome all these issues (Bora, Khairnar, Waje, Pingale and Pawar, 2015)
The manual voting process can be very tedious, prone to electoral fraud and costly. The time that is been consumed and the resources often times runs into expensive projects. The counting of ballots can also be

rigged and very much time consuming and often times results are not tallied quickly enough, tallied results seems uncertain and the credibility of the calculation is often times questioned. Semi-technological systems had solved some of these issues but create access to more problems such as persons breaking through the system to vote multiple times. (Bora et. at., 2015)

1.1   Research Motivation
The election into the students' union government offices of Federal Polytechnic Ede is paper based (Open secret ballot). On the election day, every student will proceed to the accredited voting center with the student identification card, the electoral officer would check the voters list to confirm whether the student is a registered student after which the student is given a ballot paper to vote for his preferred candidate and then leaves the poly unit. The system is characterized with many problems such as:
   a.) Stuffing of ballot box with ballot papers
   b.) Mutilation of election result sheets and falsification of election results
   c.) Harassment of voters
   d.) Delay in accreditation of the voters
   e.) High cost of voting materials
Hence the need for the development of SMVS

1.2   Design Approach
Design approach is the strategies of information processing and knowledge ordering, mostly involving software. The design approach adopted in the research is top-down modular approach. The top-down approach is essential for breaking down a system to gain insight into its compositional sub-system. Each module can be developed and tested separately to accomplish a specific task thereby leading to reduction in complexity.
In the design of the project, top-down approach will be adopted due to the following advantages.
   (i)   Easier to add a new module.
   (ii) Upgrades are made possible by making modification to the existing module rather
         than the whole complex program.
   (iii) It makes computer memory to be utilized efficiently because only the active
         modules will be located into the main memory during run-time.
   (iv)   Fewer operation during errors (because each module has to be tested separately).
   (v)   Module can be kept in a library and reused in another program.
   (vi) Several programmers can work on the same problem or program.

2.0   Literature Review
As a result of mobile phone penetration, there has been a growing number of authors who
have done research in mobile phone voting. Some of these are discussed:
The SMS Based Voting machine developed by (Ofori-Dwumfuo and Paatey, 2011) allows voters to cast their vote by sending a sms in a predefined format with a unique password and identification number in the comfort of their own homes. The voting system makes use of a pic microcontroller and a GSM modem to receive messages from voters. In this system, there are no security measures put in place to provide integrity and open to security threats.

Little and Duncan(2014) developed a biometrics authenticated mobile voting system, which makes use of fingerprint supported biometric control information and encryption as well as Secure Socket Layer to make the software more secure. Their system utilizes the existing GSM mobile system, which consists of a GSM SIM card and the software developed operates only on Android 3.0 operating system.

Hanady. and Hussien., IEEE 2013. **"**Design of secured E-voting systems." is able to desire with the widespread use of computers and embedded systems. Security is the essential problem should be considered in such systems. This paper proposes a new e-voting system that fulfils the security requirements of e-voting. It is based on homomorphic property and blind signature plan. The suggest

system is executed on an embedded system which serves as a voting machine. The system employees RFID to store all conditions that comply with the rule of the government to check voter eligibility.

Daniel and Alexandru (2015) The International Symposium on Advanced topics in electrical engineering; May 7-9, 2015. "A Hybrid mobile Biometric- based E- voting system." Information technology changes and gives shape to networked society all over the world today & its solutions are becoming main drivers in almost all field of human life activity. Although the acceptance rate of egovernment applications is increasing e-voting is hardly accepted as main tool in its field because it shortages in offering good solutions to common problems like fraud, bribery, anonymous character of the vote and absence of good independent monitoring.

3.0 Research Methodology
3.1 Data Collection
The following methods were used in collecting data during the preliminary study. Details about voting system by Students' Union Government at Federal Polytechnic were acquired through the following fact finding methods:

    (i) Relevant materials such as books, journals and conference papers on Mobile voting perused
    (ii) Students were interviewed so as to know the challenges been faced during the students union election.
    (iii) Personal observation during the conduct of the election was also documented.

3.2 SMVS System Architecture
A system architecture the conceptual model that defines the structure, behavior, and more views of a system. An architecture description is a formal description and representation of a system, organized in a way that supports reasoning about the structures and behaviors of the system (Arson and Belenky, 2006) Software application architecture is the process of defining a structured solution that meets all of the technical and operational requirements, while optimizing common quality attributes such as performance, security, and manageability. It involves a series of decisions based on a wide range of factors, and each of these decisions can have considerable impact on the quality, performance, maintainability, and overall success of the application (Daniel and Alexandru, 2017)
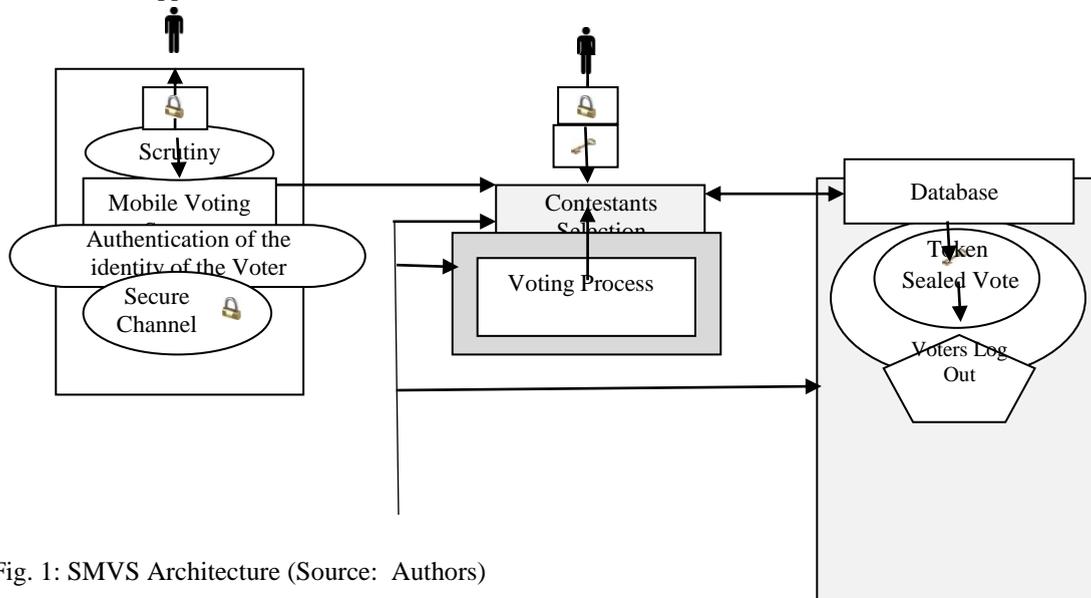

Fig. 1: SMVS Architecture (Source: Authors)

3.3 Database Design

Database design is the process of producing a detailed data model of database. This data model contains all the needed logical and physical design choices and physical storage parameters needed to generate a design in a data definition language, which can then be used to create a database. The database of the system is design in a flexible manner and very robust system the database is design using mysql and the relationship of the data in database is shown in Figure 2.
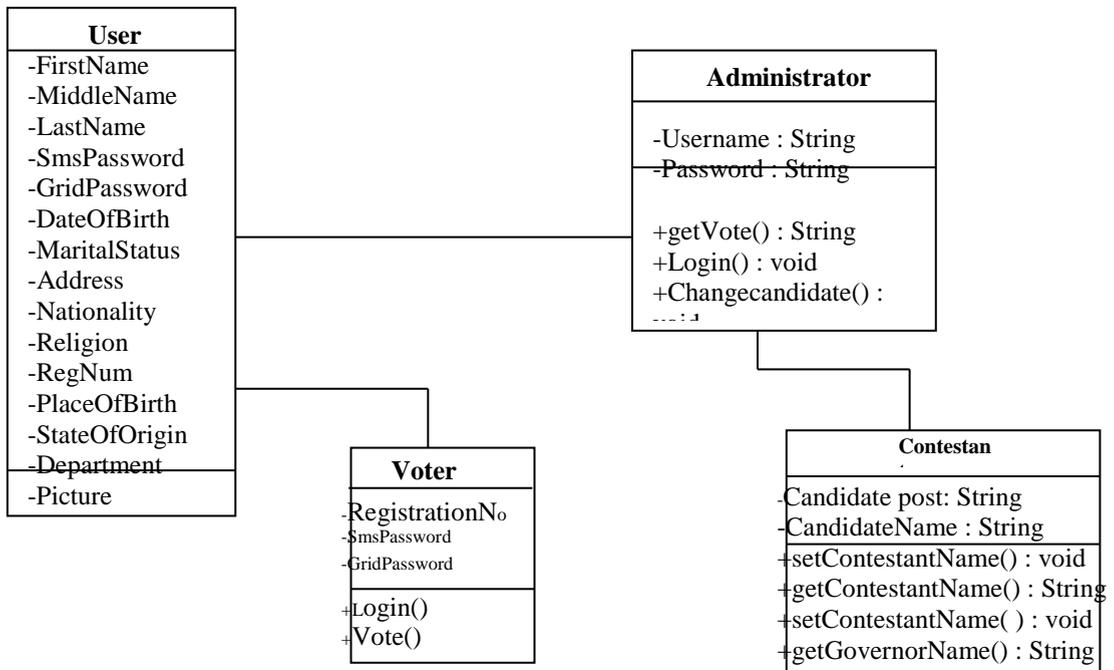
User
- -FirstName
- -MiddleName
- -LastName
- -SmsPassword
- -GridPassword
- -DateOfBirth
- -MaritalStatus
- -Address
- -Nationality
- -Religion
- -RegNum
- -PlaceOfBirth
- -StateOfOrigin
- -Department
- -Picture

Administrator
- -Username : String
- -Password : String
- +getVote() : String
- +Login() : void
- +Changecandidate() :

Voter
- -RegistrationNo
- -SmsPassword
- -GridPassword
- +Login()
- +Vote()

Contestan
- -Candidate post: String
- -CandidateName : String
- +setContestantName() : void
- +getContestantName() : String
- +setContestantName( ) : void
- +getGovernorName() : String

Figure 2: SVMS class diagram

4.0   Results and Discussion

The log-in screen gives the eligible voters access to log in into the system. Here the user log in with matric number and password before he/she can be allowed to use the system. When the eligible voters log in to the system, then he can have access to other modules of the system which includes voting module.
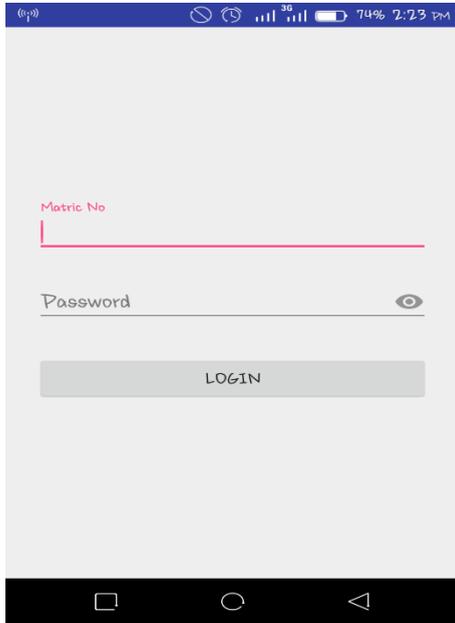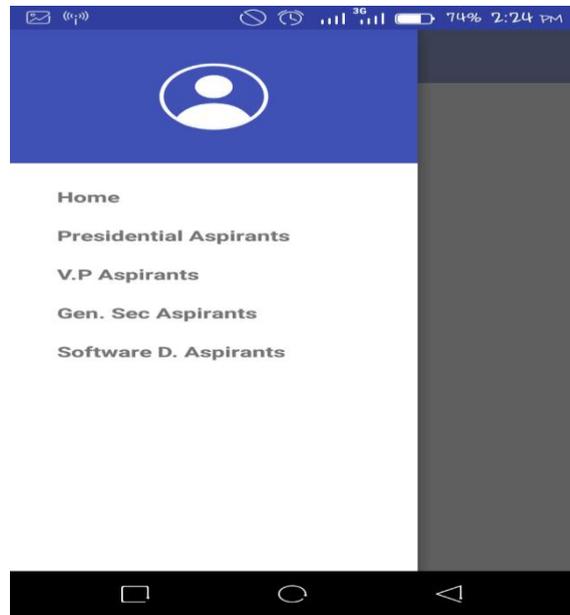
Fig 3 : Log-In Screen   Fig. 4: Contestable Post Screen

When the valid users log in to the system and ready to vote, he can then preview the list of available contestable post before proceeding to voting section, here the voters can click on a post to preview the list of contestant for a post so that the voter can select the preferred candidate.

AspirantListScreen
Aspirant list screen is displayed after when the user has been confirmed as the eligible voter, the voter preview the list of the contestable post and he click on the post to view the list of contestant for the post. Here the voter can now click on the preferred candidate.
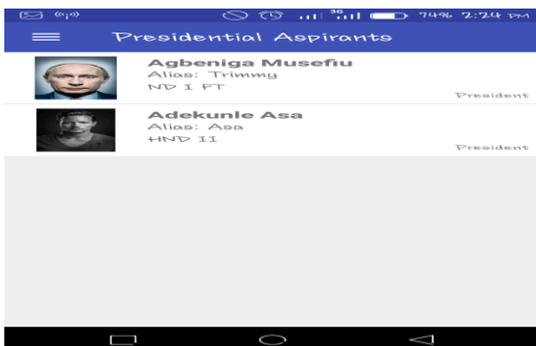

Fig. 5: Aspirant List Screen

List Of Aspirants

Aspirants From Database

#ID	Name	Position	Total vote	Action
8	Agbeniga Musefiu	President	3	Delete
9	Asagade Oyewale	President	2	Delete
10	Adeyemi Banji	Gen. Sec	2	Delete
11	Kalejaiye Agbeniga	Gen. Sec	0	Delete
12	Oluwatoyin Kemisola	Vice President	1	Delete
13	Yusuff Alao	Sport Director	1	Delete
14	bamgboye ponmile	Financial Sec	1	Delete
15	oyedele adenike	Financial Sec	0	Delete
16	adebayo tosin	Sport Director	0	Delete
17	ibrahim adejoke	President	0	Delete

Figure 6: Election Result

Features of SMVS
The SMVS uses mobile phone device having: small in size, low power, low-price as compare to manual voting system.
The key features of SMVS:
1. Eligibility: only authorized voter can cast their vote.
2. Uniqueness: Each user can cast their only one vote.
3. Integrity: Valid vote should not be modified or deleted.
4. Fairness: The election result should not be accessible before the official time ended.
5. Secrecy: No one should be able to find how voter cast their vote.
6. Cost-effectiveness: Election

5.0   Recommendation and Conclusion

5.1   Conclusion

Mobile technology is ubiquitous today. Even some people who may not have regular access to a computer often carry a smartphone. Phone-based solutions can be ideal for enabling voters to quickly and easily get information about candidates, register to vote, and check in at polling centers. Unlike paper-based systems, a mobile solution would make the process easier and faster. It could also, arguably, be more reliable than physical/paper ballots. There are also the cost savings to government (and therefore taxpayers) from the elimination of thousands of polling stations, not to mention back office and technical

support. This research work was able to make election process easier and faster, more reliable and the problem of intimidation and harassment would also be an events of the past.

5.2 Recommendation

SMVS contributes to the voting system reform by designing and developing a mobile phone voting framework and an application. The application facilitates users to spontaneously and timeously vote using existing mobile phone networks and technologies. The system if implemented will enhance free, fair, credible and acceptable election and people will exercise their voting right without any fear of molestation, harassment and any other form of challenges that may arise from manual/ secret ballot system

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