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# **Design and implementation of an online voting system for the election of students of the University of Mauritius**

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**ABSTRACT:** Voting systems have been present for long time but, with the emergence of new web technologies, the conventional electoral process, be it is for general election or for electing candidates for student council in a university, should be modernized. Electronic voting is one of the most troublesome overhauls faced to obtain a perfect outcome hence, this innovation touches the heart of the whole electoral process that is voting and tallying of the votes. Online voting significantly decreases direct human control which is viewed as a positive point but at the same time it presents an entire scope of new concerns.

This paper provides the specification and requirements to meet ‘University of Mauritius (UoM) Student Online Voting System which is an android based application to be used by the students of University of Mauritius during the Student Union Election. It covers the entire system development life cycle from the identification of a solid problem to background research about the topic on to analysis, design and implementation of an android based application. The concluding sections cover the application testing and evaluation as well as possible enhancements to the application.

**KEYWORDS:** Electronic voting, software engineering, Android package development

## **I. INTRODUCTION**

Voting is fundamental in our modern societies. In line with this, mobile applications are being developed and deployed on smart phones to make the voting process much more simple and effective. It is a matter of fact that these applications have raised our standard of living whereby people can rule the whole world at their fingertips’-voting systems have been introduced to enhance several features of the electoral process [1]. It is generally perceived as a medium for promoting democracy, establishing belief in electoral management, adding integrity to election outcomes and improving the overall efficiency of the electoral process [2].It is a fact that, with proper implementation, online voting system can get rid of several frauds, pace up the preparing of results and make voting more appropriate for the public.

However, if not precisely devised and outlined, online voting may ruin the trust in the entire electoral process [2,3]. This research work investigates the design of an online voting system that can be used at university level to proceed with their annual election. This system will be an altogether paperless one since it will eliminate all the manual tasks. Students can access the application on their mobile phone, wherever and whenever they desire and choose their student bodies provided they have internet connection. Students will no longer have to wait for long hours to obtain the result since the system will provide real time results.

## **II. VOTING SYSTEMS**

Traditional voting system also known as ballot voting system is a method by which recording and counting votes are carried out on paper cards. For this type of election, the most well-known approach to voice out one’s decision is voting at a particular area known as the polling station [2].Traditional voting systems can be classified into several types namely majority rule, proportional



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representation, semi-proportional representation, plurality voting, preferential voting and many others whereby majority rule is a decision rule that chooses those having dominant part, that is, more than a large portion of the votes [3-5]. Proportional representation characterizes electoral systems by which divisions in an electorate are reflected proportionately in the chosen body.

On other side, plurality voting is a voting framework in which every voter is permitted to vote in favor of one and only competitor, and the applicant who surveys most votes(majority) than other is elected. Ranked voting system also known as preferential voting is a method where candidates are ranked in order of preference.

Electronic voting (otherwise called e-voting) will be voting using an electronic device to record or check votes. Online voting system introduced numerous advantages. Some of the benefits include lesser fraud, lesser cost, accurate counting. But, based on other's work, several cases cropped up where electronic machines making capricious and conflicting mistakes or making ill use of default administration passwords [1-3]. Some types of e-voting systems are summarized below.

## 1. Direct-Recording Electronic Voting System(DRE) [2]

DRE is known as the most technologically advanced system. It is carried out through the use of a computer. Touch screen or any similar electronic device is used for a voter to make his choice. The votes are stored in a memory device which will be sent to a centralised voting station. At the station, the voting data are tabulated data by the use of computer programs and again stored in memory devices.

## 2. Optical Scan [1]

In this type of electronic system, an optical scanner is used to capture the data and converts it to computer-readable data. The voter is given a ballot paper at the polling station and after voting the latter can either feed it directly to the tabulating device or put it in a ballot box which will be tabulated afterwards.

## 3. Punch card voting [1]

With punch card systems, voters punch holes in cards using a supplied punch device, to indicate votes for their chosen candidates. After voting, the voter may feed the card directly into a computer vote tabulating device at the polling place, or the voter may place the card in a ballot box, which is later transported to a central station for tabulation.

## 4. Internet Voting [1]

Internet voting system is one where votes are transferred via the Internet to a central counting server. Votes can be cast either from public computers or from voting kiosks in polling stations or more commonly from any Internet-connected computer accessible to a voter.

With this new and effective way of voting, more accurate results could be obtained for a minimum effort. Also, more people can participate in voting, thus increasing turnout. Invalid and lost votes can be occurred with very little possibility or sometimes eliminated completely. A properly designed online voting system has safeguards in place to assure security of ballots and protection of voter identities [1]. Despite the particular advantages to electronic voting system, critics of electronic voting argue about the security issue. The attacks might be happened from the webpage, network, to the extent of server's database [1].

### III. SYSTEM ANALYSIS OF PRESENT VOTING SYSTEM AT UOM

At the UoM, election takes place every year. The University of Mauritius can be classified into five faculties. For the student union election, each student has to choose their respective faculty representative and four office bearers(irrespective of the faculty). This electoral procedure involves many processes. The processes involved are listing all eligible students, Voting, Vote Counting, Collation and Publication of Results.

The procedure for listing all eligible students is to enable an eligible voter to have his/her name entered into a document (Voter Register) with the aim of offering the person the opportunity to exercise his/her franchise on the appointed day of voting. The Voting is the actual process of casting ballots. An eligible voter goes to the polling station where his name is registered and uses his Student ID card to vote. Firstly, he is issued a ballot paper to cast his vote. In an



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enclosed space, he selects a candidate of choice on the given ballot paper and thumbprints in a space allotted for that candidate. The voter then carefully folds the ballot paper and deposits it into the ballot box provided. He is then expected to leave the polling centre. The processes of Vote counting and publication of results consist of Ballot counting which is done manually and after that the result is published.

The present system of voting whereby the voters go to the voting place to perform their duty and the results are counted and given to students undoubtedly conveys numerous drawbacks given below and which need to be taken into consideration:

- **Counting process is slow**  
There are around 9000 students at the University of Mauritius and assuming that three-quarter of the university population has voted gives rise to a large amount of ballot papers. And counting all of them is a very time consuming process.
- **Errors during the counting process**  
It is possible that the counting process contains errors because humans are subjected to errors.
- **Absenteeism**  
The current voting system requires the voters to vote only in polling centers. Statistics show that the main reason for absenteeism is that students do not have lectures on election day(therefore they feel no need to come to the university especially to vote)or some do not want to wait for long time in the queues at the polls.
- **High cost**  
This type of voting is very expensive as both human and financial resources are involved.UoM administrative staffs are assigned to look after the proper functioning of the election and it is costly to print ballot papers and counting sheets.

## IV. SYSTEM SPECIFICATIONS

The 'UoM Online student Voting System' will act as a client/server application. It will describe how a user can vote using an application installed on his Smartphone. This system comprises of a Mobile Client Application, Server Application, Web administration panel and a central database. The programming for this application is based on the traditional client/server model [5-7]. The mobile client application can be downloaded and connects to the server application using *volley* library and requests for voting *data*. *droid Volley* is an HTTP library that makes networking for Android apps easier and most importantly faster [8-11].

Response received is converted to *JSON* format that can be read by the Android system. To be able to use this library, we need to add *volley* library to the project. The server application queries back the Central database and send the data to the Mobile Client Application. The user is presented with a screen where he/she can choose the desired candidates. Once the user has voted, the data is transferred to the server application, which then performs validation and updates the database if successful. Even though the system enables voters to poll their vote from anywhere, initially the voters should have to provide their student ID and password to authenticate themselves. This constraint is imposed to ensure that only the students studying at UoM are allowed to vote in the election. The aim of this work is to design and implement an electronic voting application for the Android platform that will enable people to vote securely from anywhere [12].

The application as a package is aimed at being compatible with devices running different versions of the Android operating system. The web administration panel is connected to the central database where the administrator can add new applicants, delete an old applicants and also view voting statistics. Moreover, a student can see the voting results provided he has already voted.

## V. SYSTEM DESIGN AND IMPLEMENTATION

The Application Architecture describes the layout of an application's deployment. The architectural structures can be grouped into several types namely 1-tier, 2-tier, 3-tier and n-tier. The tiers given below alludes to different level or layers where activities occur.

- *Client*  
Client is any user or program that wants to perform an operation over the system. Clients interact with the system through a presentation layer.
- *Presentation Layer*  
This layer is responsible for the presentation of data at the client side, i.e., it provides an interface for the end-user into the application.
- *Resource manager*  
The resource manager deals with the organization (storage, indexing and retrieval) of the data necessary to support the application logic. This resource manager is typically a database.
- *Application logic*  
The application logic figures out what the system actually does. It takes care implementing the business rules and establishing the business processes. UoM online voting system is designed and implemented according to the three tier architecture.

As mentioned earlier, this model is divided into three layers namely the presentation layer, application layer and data management layer. The Presentation layer also known as client tier is responsible for the presentation of data, receiving user events (votes) and controlling the user interface. Secondly, the application layer (application server tier) protects the data from direct access to the clients. It is the layer where most of the processing work occurs that is it enables access to the data tier so as to retrieve, modify or delete data from it which can then be sent to the presentation layer. Lastly, Data Management layer (Data server tier) is responsible for data storage using MySQL as database software [13]. Fig. 1 shows a three tier architecture which is used in designing the application [4].

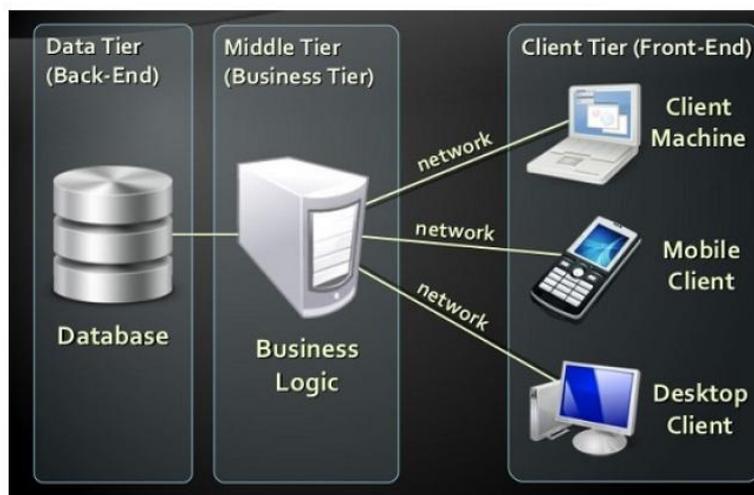


Fig. 1: Three tier architecture [4]

The application will be built from scratch to meet all the functional and non-functional requirements specified. The application is aptly named UoM ONLINE VOTING SYSTEM and it will be built using android development tools – Eclipse IDE with Android Software Development Kit (SDK). The Eclipse Android SDK is freely accessible and has developer features for testing in a simulated environment using an emulator; however because of the widespread availability of android devices and phones, it will also be possible to test on live applications. Two other important tools used are WAMP Server and MySQL database [13].

The laptop used to implement our project has the following upcoming configurations: Intel<sup>®</sup>Core<sup>™</sup> i3 CPU M 370 @ 2.40GHz, RAM - 4GB, Hard Disk - 282 GB. The mobile phone that has been used for the development of the application is given as follows: Mobile Android 4.2.2 Jelly Bean, Processor Quad-core 1.9 GHz Krait 300, RAM-2 GB. The software that have been used in this work are as follows: Windows 10 Home 64bit, IDE Eclipse Kepler 4.3.2, Android SDK, Notepad++ 6.8.8, Microsoft Visio 2013, LATEX

## V. SYSTEM RESULTS AND DISCUSSIONS

When the application opens, the splash screen loads first. Then, the login page is launched as shown in Fig. 2. If the ADMIN button is clicked then the Administrator web page opens requesting for login information as shown in Fig. 3. If the wrong login is entered an error message is displayed requesting the user to re-enter the correct login. Upon successful login the administrator will have access to various features of the e-voting system that can be configured as illustrated in Fig. 3.

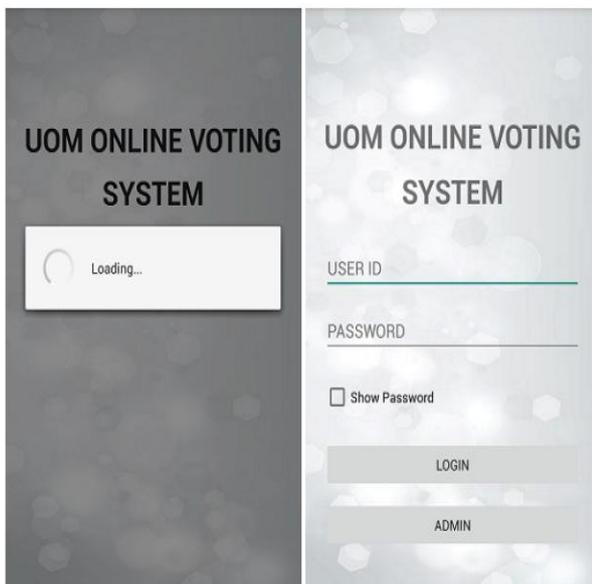


Fig. 2: Splash Screen and Login page

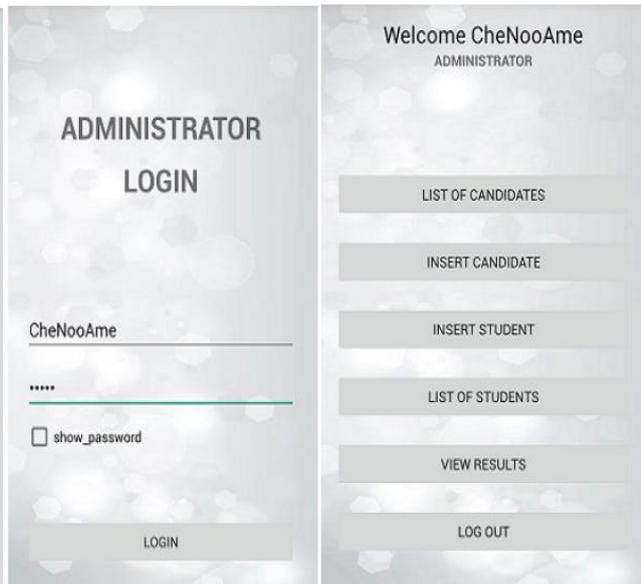


Fig. 3: Administrator Login page

Fig. 4 shows an example of a student who has been added and updated or deleted successfully in the system. As illustrated in Fig. 5, before voting the voter is directed to another page which shows the voting ballot (list of candidates). After voting, a toast is displayed “*You have already voted!*”. Moreover, before voting, a message is displayed “*You can only view results after voting*”. After voting, the voter is directed to the result page.

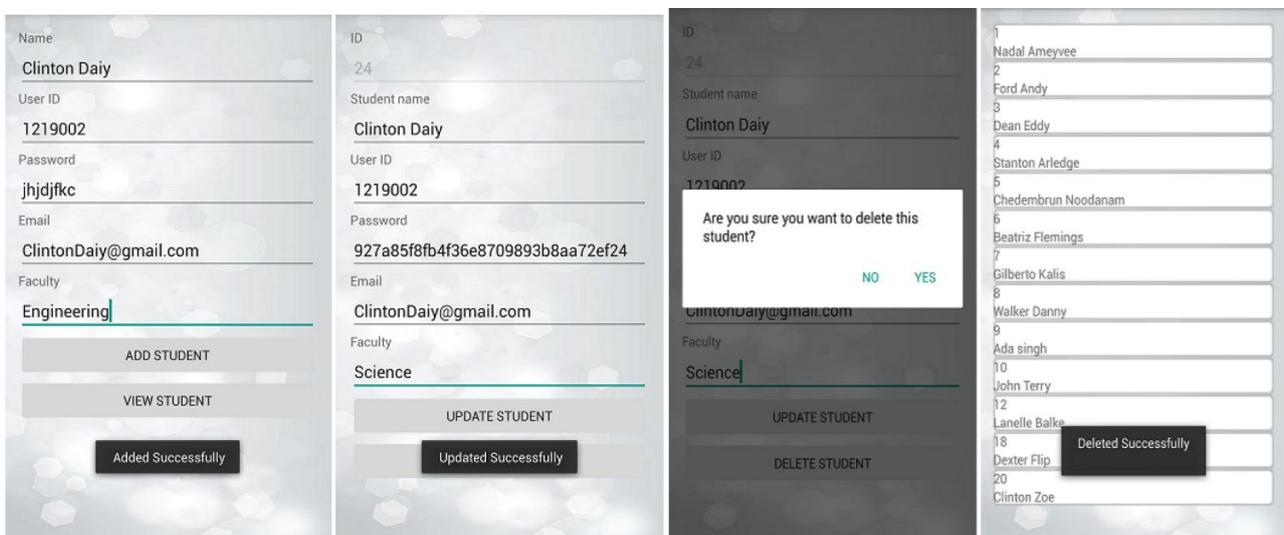


Fig. 4: Test case: Add/Delete/Update student

When the student accesses the candidates profile link a dialog box opens showing student representatives and office bearers. The student is allowed to view profiles and cast a vote based on his/her choice. A maximum of 4 candidates is allowed to vote as shown in Fig. 6. After voting the system displays the result as shown in Fig. 7.

## V. CONCLUSION

This paper focused on the development of an e-voting application on an android platform. It successfully met its aims and objectives and all the requirements mentioned earlier were met. It will definitely be helpful for the users who wish to vote since the voting process will be made very easy by using this application. However, after having tested the system, in future we tend to add additional functionality of image validation for the security constraint and uniqueness which will provide very strong security for the confidential information about vote. Furthermore, a countdown timer can be introduced to set the starting and ending time of the election. Alongside, the users are informed of the starting time through a message and can start voting. In between, statistics are provided and once the timer is over, the voting process is blocked automatically and the users can only view the final results.

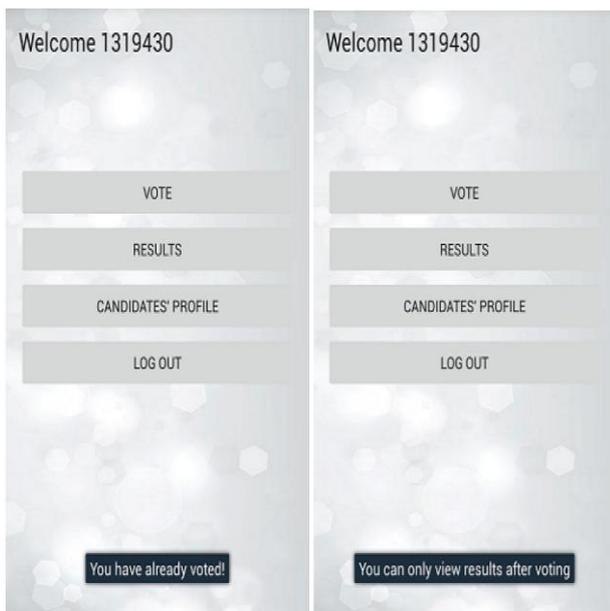


Fig. 5: Student home page

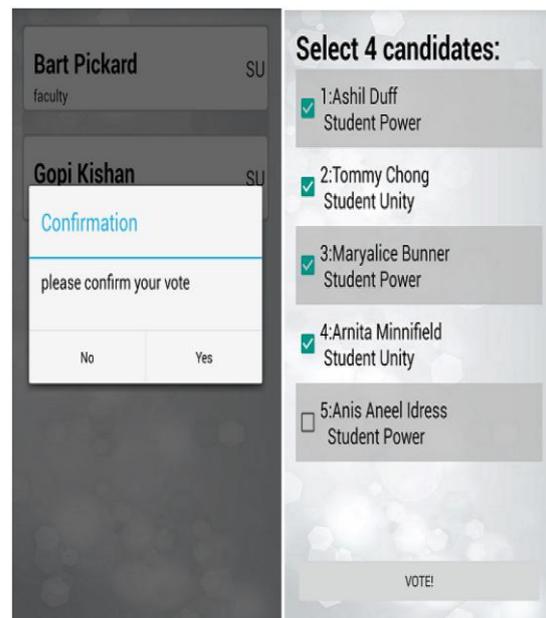


Fig. 6: Voting process

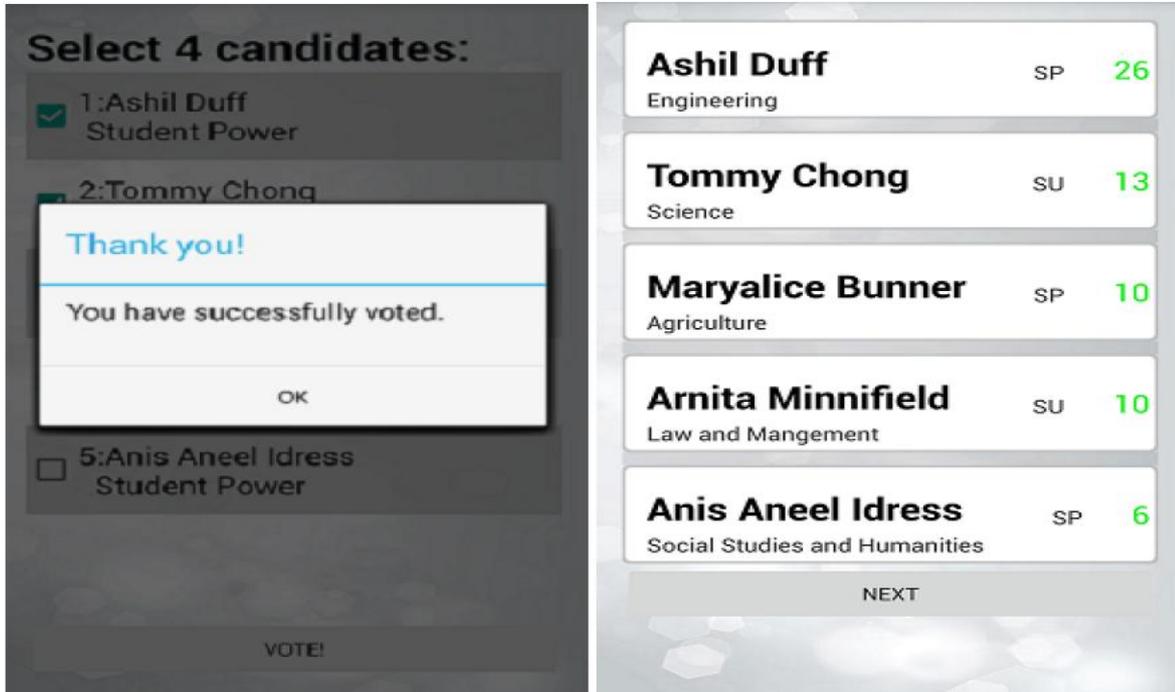


Fig. 7: Vote result

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