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RESEARCH ARTICLE OPEN ACCESS

A MOBILE VOTING SYSTEM: ENHANCING EFFICIENCY AND SECURITY IN THE VOTING PROCESS

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ABSTRACT

This paper introduces a mobile voting system, an innovative application that enables the casting of votes using mobile phones. Traditional manual voting methods, such as paper ballots, are outdated and cumbersome in today's technologically advanced era. The mobile voting application brings the voting process to users' mobile handsets, offering an efficient, convenient, and secure mechanism for voter registration, login, and vote casting.The mobile voting system reduces the need for extensive planning and human resources in conducting elections while ensuring voter confidentiality. Voter authenticity is verified using registration numbers and passwords. The system architecture consists of three layers: presentation, application, and database. The presentation layer serves as the user interface for the admin, voter, and aspirant. The application layer processes data and manages access to the database, while the database layer stores, indexes, and retrieves data to support the application logic.The results of this study demonstrate that the mobile voting system is a secure and efficient solution that significantly enhances the voting process. It can accommodate large numbers of voters with minimal effort and can be completed quickly. By implementing this mobile voting system, the accuracy, efficiency, and security of voting processes can be improved, ultimately promoting more accessible and convenient elections.

Keywords*: Mobile Voting System, Application Architecture, Voter Authentication, Mobile Application*

1. INTRODUCTION

The term voting is understood to be a form of choice. This form of expression can be performed through the ballot or other electoral schemes (Ali & Shaker, 2023). The contestants campaign to attract voters using posters, letters, face-to-face contact, phone calls and text messages (Aurangzeb & Aleem, 2023). Interested candidates pursue the students to come and vote for them to occupy certain positions.

On elections day, the students cast their votes for their preferred candidates, and the ballots are sorted, counted, and the winners emerge. All these processes are carried out manually. This is very inefficient and time-consuming and is subject to malpractice. This consequently leads to poor voter turnout because the system is not convenient for most students(Fortuna &Khaeruzzaman, 2022).Given this, an

Android-based Mobile Voting Application is proposed for NILEST SUG to adopt for its elections. This application will enable the students to cast their votes online and track the results in real-time, providing candidates with a centralized platform to campaign and an interactive platform between the candidates and the voters. This will transform the current paper-based voting system into a mobile system (Kamaluddin,2018).

Voting is the process of expressing one's preference for a candidate. Elections form a critical function in democratic systems, andthe application of information technologies to their management is an excellent milestone towards realizing effectiveness and efficiency in the results of the election process((Sebi*et al.,* 2023).NILEST SUG needs computerized management of student union elections due to the shortcomings in the 'human clerk 'electioneering system. The various drawbacks of a traditional electioneering system are mainly the queuing time, delayed results, and the undeniable fact of human errors. The existing voting system did not provide reliable statistics on voting history in the college. Thus campaigners lacked the ground to apply scientific voter forecasting methods resolving to trial and error methodologies which are error-prone and inconsistent (Kamaluddin,2018).

Reinforcing a voter one-vote policy is difficult in such a situation, and malpractices such as rigging are not uncommon in the human clerk system ((Budhiraja, 2022).The system currently used by NILEST SUG is paper-based, making it insecure and prone to errors.The voting process is nowprolonged and time-consuming.The voters are not registered just before the poll, so there is the possibility someone who is not a student can fake an ID and registration number to partake in the students' elections(Adeniyi*et al.,* 2022). They add the new students with the previous students, sothere is no accreditation. Students cannot track the voting process in real-time within the allocated voting time.If a student is absent due to unavoidable circumstances, they will not vote. Votes are counted manually, so the process becomes gradual, which may be inaccurate, and humans are prone to errors. Voters do not get to know the final voting result on time.

The evolution of technology in the development of applications for different use and advancement in the knowledge of computing; interest in how these things work and affect human life is quite a motivation (Pandey, 2022).This project aims to design and implement an Android mobile voting application.Given the rapid development of computer technology in virtually all fields of operation and its use in information management, it has become essential to look into developing a mobile voting system to achieve the following;Conduct free, fair, and credible elections.Safeguarding data and information in the system(Sherine, 2022)—reduced workload in conducting elections.Keep an accurate record of votes.Reduce time wasted in announcing election results.Eliminate disenfranchising electorates.

1.1 SYSTEM ANALYSIS AND DESIGN

1.1.1 SYSTEM STUDY

Voting applications are required to make choosing a representative easy and quick. Voters cast their votes on the Internet. It is the latest, most innovative technology being used to conduct elections. It has many advantages like portability, higher speed, mobility and reusability. A mobile application is preferred as it can be efficiently utilized since Smartphones are widely used.

Thinking about the analysis and design of computer-based applications provides a framework for visualizing the organizational and environmental factors that operate on a system. When a computer is introduced into an organization, various functions and dysfunction work on the user and the organization.

The positive consequences are improved performance and a feeling of achievement with quality information. Among the unanticipated consequences might be a possible threat to employees' jobs, a decreased personnel morale due to lack of involvement and a feeling of intimidation by users due to computer illiteracy. The analyst's role is to remove such fears and make the system successful. System analysis and design focus on systems, processes and technology (Kamaluddin,2018).

1.1.2 ANALYSIS OF THE EXISTING SYSTEM

In the existing voting method, the aspirants' campaign for days before the elections. They place their pictures on the notice board and entrance of the institute with the date of the polls written on it. On that day, students queue up outside a said classroom with their student identification cards. The student identification cards serve as student accreditation. The ID cards make the student an eligible voter. The student picks up the ballot paper with pictures of the aspirants and the position they are contesting for. The student ticks the candidate he wants, slides it in the box, and leaves. The votes are counted when the election is concluded and the result is announced.

1.1.3 PROBLEMS WITH THE EXISTING SYSTEM

a. Long queue
b. Absenteeism
c. Counting votes takes a lot of time and is prone to severe errors and manipulations
d. Someone can cast a vote for another absent voter, which is fraud
e. The system is insecure because it can be rigged and types of fraud committed, for example, past students invited to vote.
f. The election clerks may lack training in human relations and may be unfriendly. This can make a voter uncomfortable.
g. Humans are known to have reservations regarding issues concerning gender, religion, language, disability, marital status, etc. This may affect voters turnout

1.1.4 PROPOSED NEW SYSTEM

The mobile voting system is an Android application enabling users to vote on their smartphones. This is more advanced than the present system because voters don't need to visit the polling booth.

Step 1: Registration of voters

Registration of Voters by uploading a list of eligible voters' names and registration numbers in the database. These are only used for security purposes to authenticate the voting members. User Information Is stored in the database, So that the valid users can register themselves to get the password.

Step 2: Voting

Voters must install the mobile application on their smartphones; their identity is authenticated via a registration number. This allows them to start voting at the right time when the voting portal is open. When they submit a ballot, the database keeps their answers safe. Security-wise, a voter can only vote for a particular post once; voting is anonymous (nobody knows who votes who) voters cannot change their votes.

Step 3: Results

Results are viewed as the election process is on that is in real-time

2. FEASIBILITY STUDIES

A *feasibility study* is an *analysis* that considers all of a project's relevant factors.To determine whether or not a given project is feasible, i.e., to determine whether the change can be carried out within

reasonable time and the properties to be identified and development of the high-level model of the proposed system, there must be some form of investigation into the goals and implications of the project.

I. Technical Feasibility

This part concerns the availability of equipment, hardware, and software and the knowledge of how it will be required when developing a system that will promptly respond to the user's request.

II. Economic Feasibility

This involves the study to determine if the cost of developing a system will be lower than the overall benefits enjoyed after doing so or higher in price based on the use attached to the system to be designed.

III. Operational Feasibility Study

Operational feasibility measures how well a proposed system solves problems and takes advantage of the opportunities identified during scope definition and how it satisfies the requirements specified in the requirements analysis phase of system development.

IV. Scheduled Feasibility

Scheduled feasibility is a measure of how reasonable the project timetable is. A planned feasibility study will take into account the period in which the project will take up to its completion. A project will fail if it takes too long to be completed before it is functional.

2.1 NEW SYSTEM DESIGN

Systems design could be seen as applying systems theory to product development. Systems design defines the architecture, modules, interfaces, and data for a system to satisfy specified requirements. The purpose of the System Design process is to provide sufficient detailed data and information about the system and its system elements to enable the implementation consistent with architectural entities as defined in models and views of the system architecture.

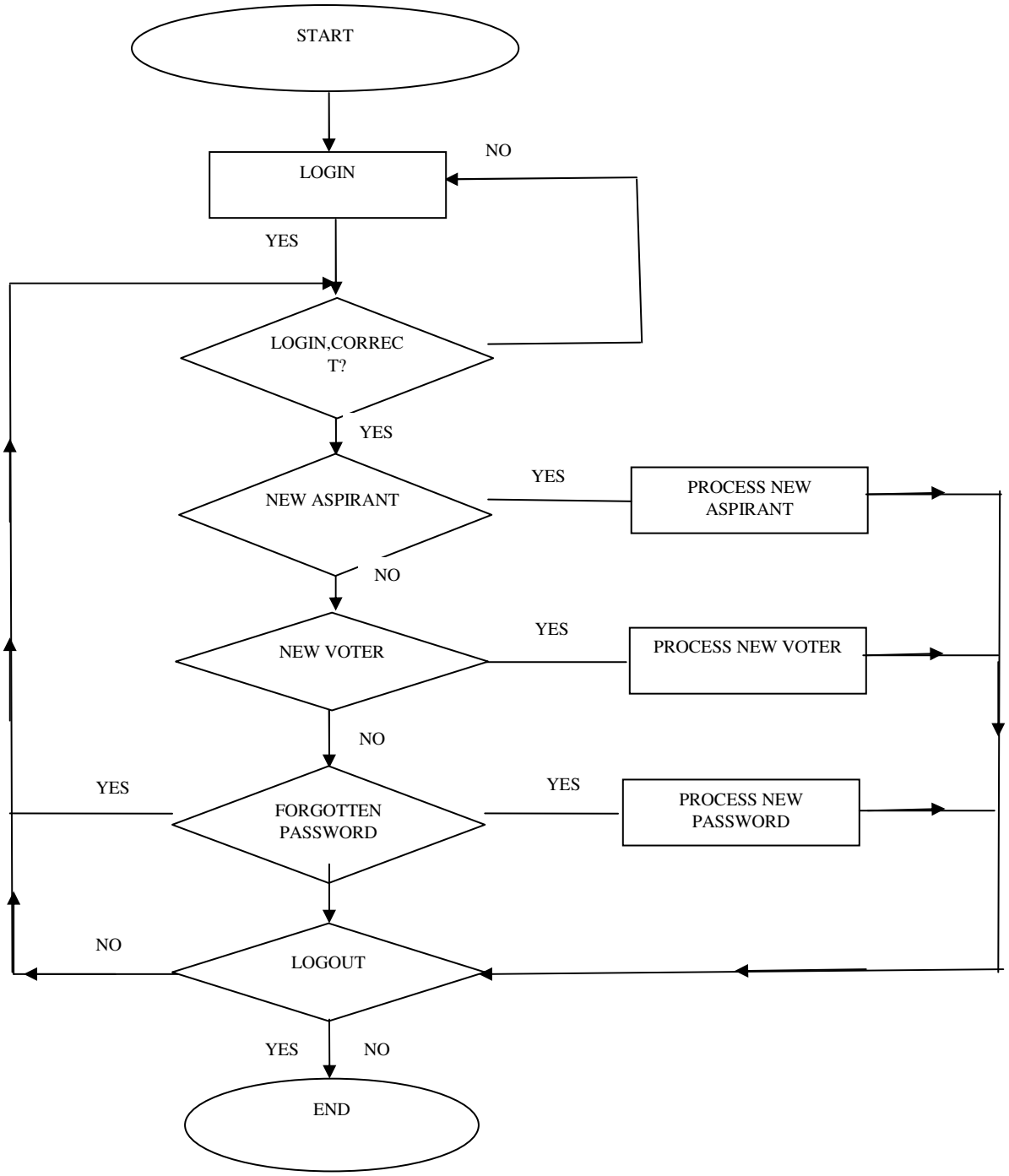


FIGURE 1: Login Flowchart

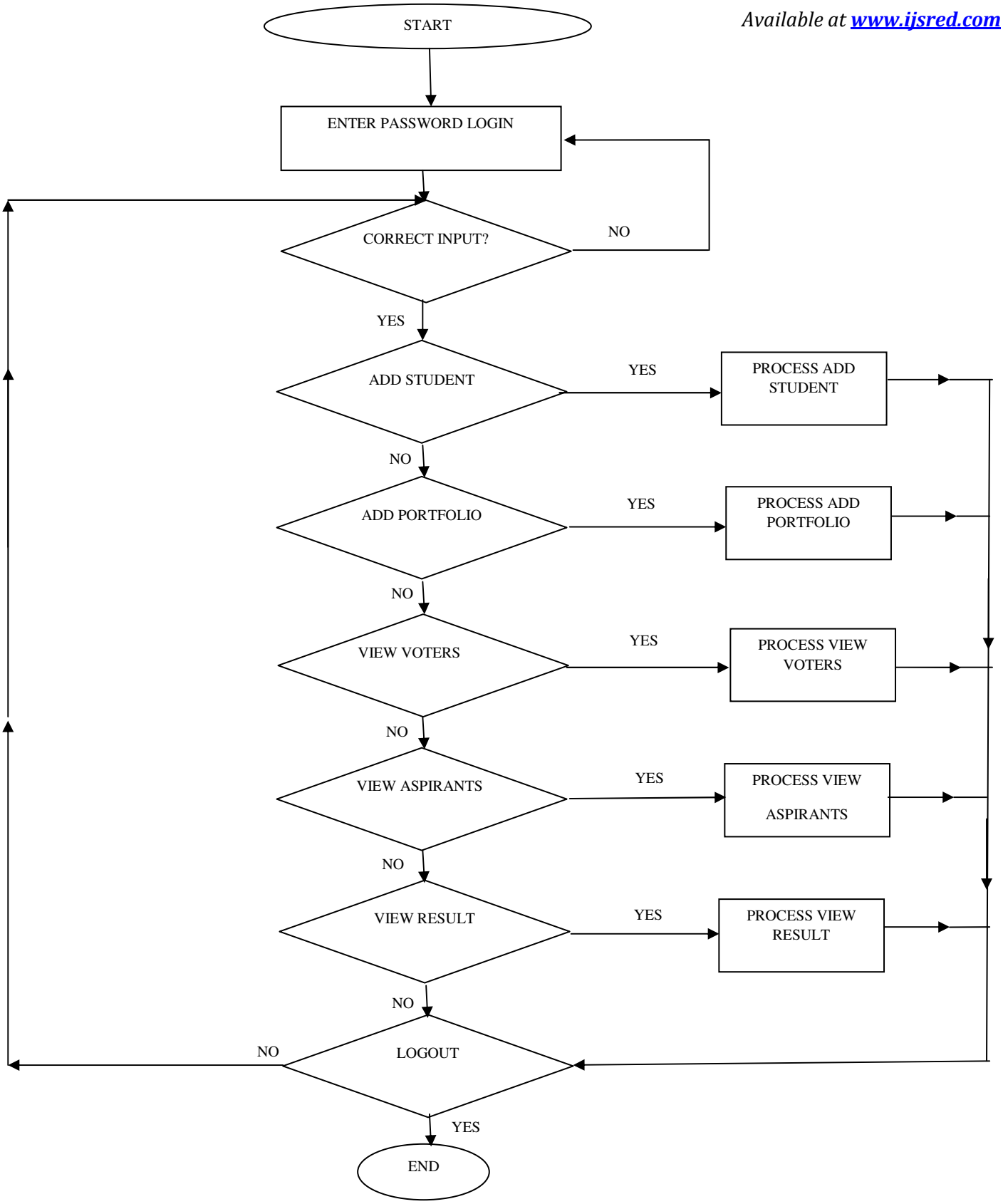


FIGURE2: Admin Flowchart

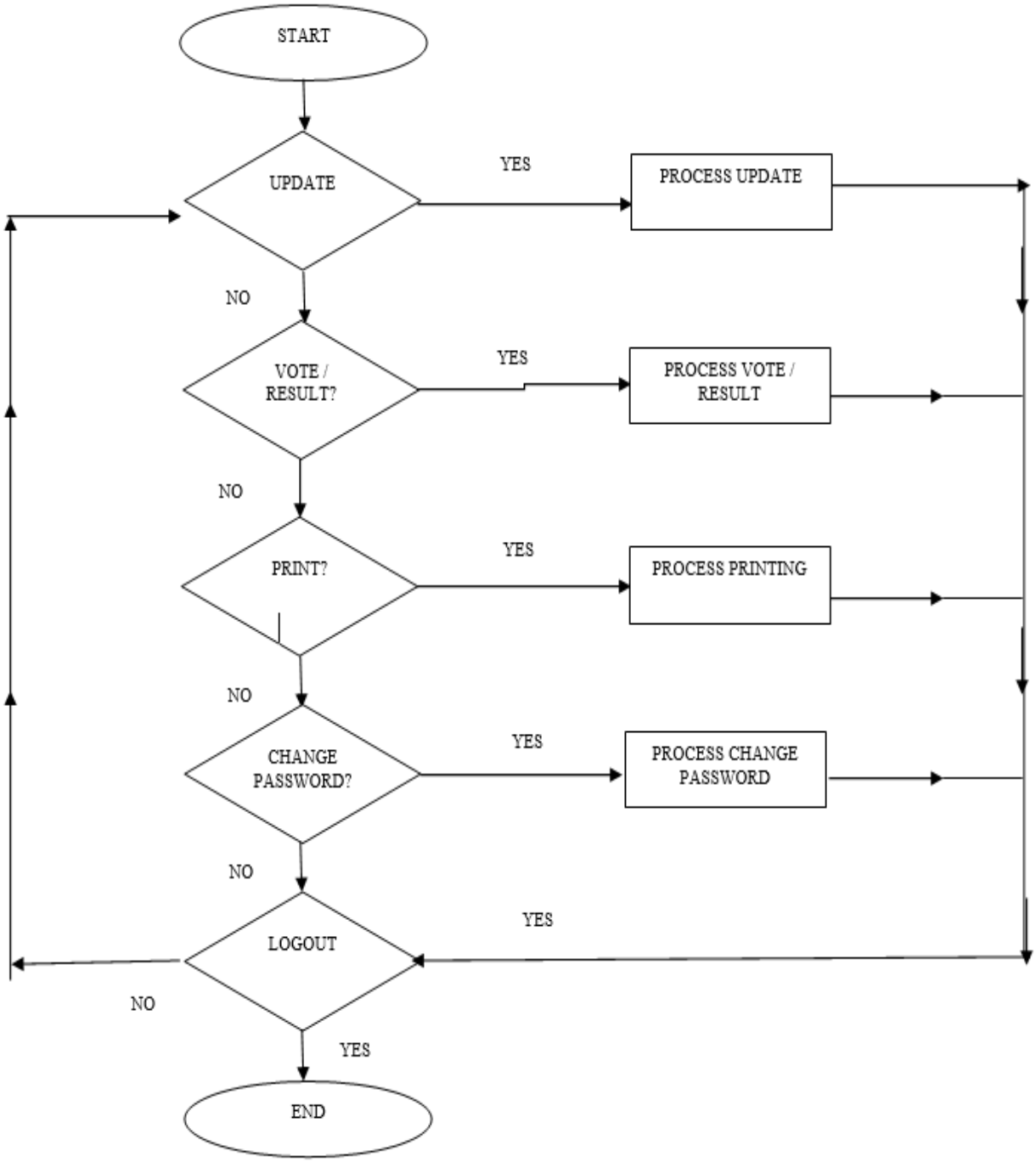


FIGURE 3: Voter and Aspirant Flowchart

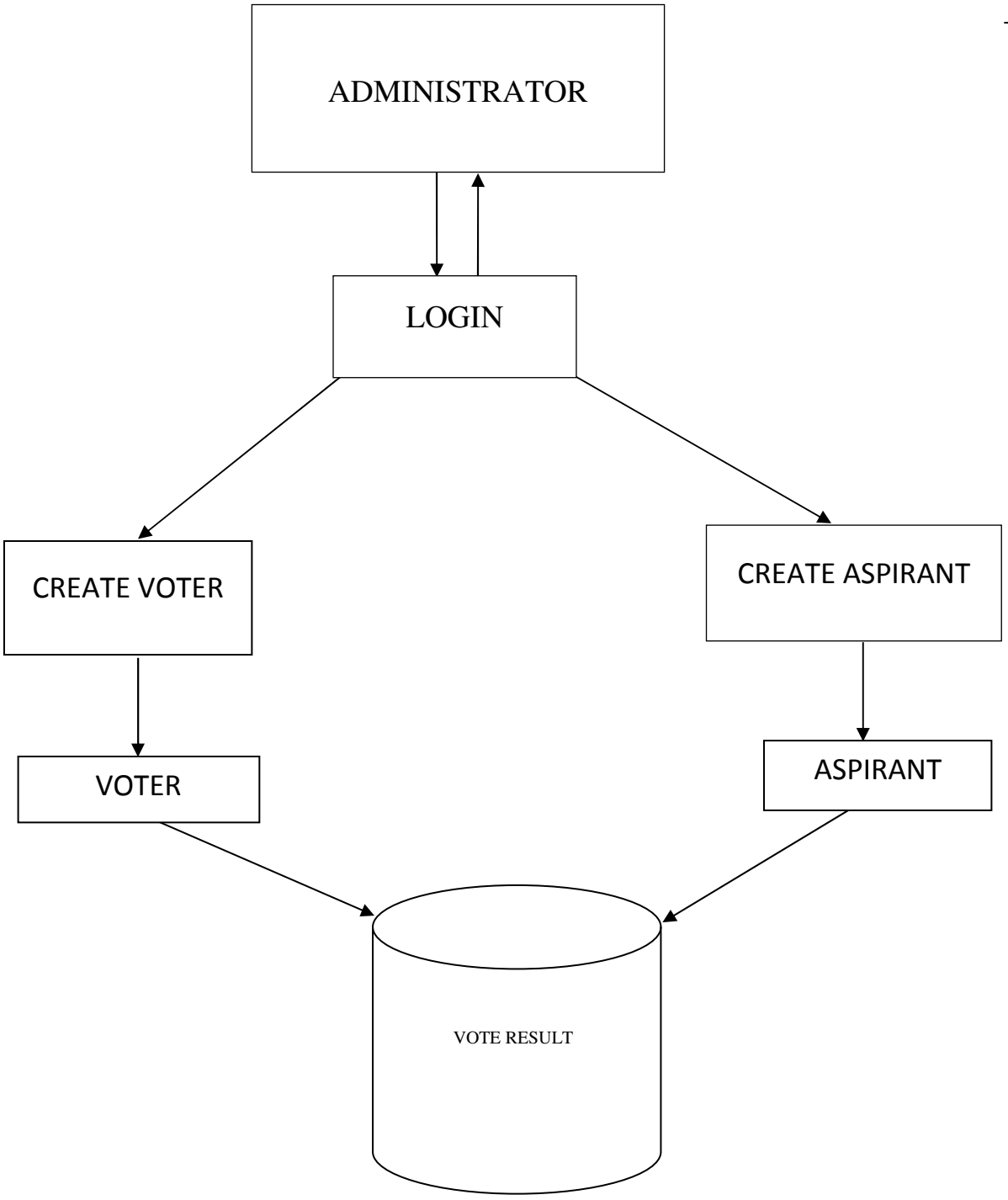


FIGURE 4: Data Flow

2.2 INPUT SPECIFICATION

Input specifications specify precisely how the desired outcome should be achieved. This is generally based on a schedule of tasks, frequencies, and methodologies dictating precisely what should be done, when and how.

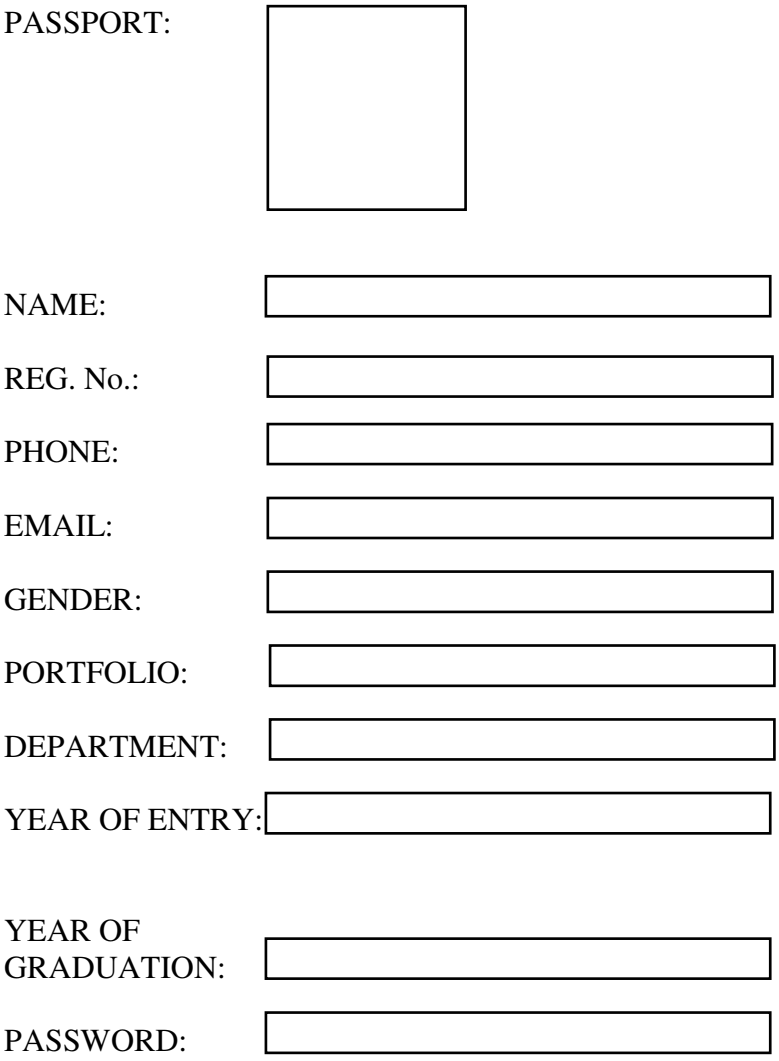


FIGURE 5: Aspirant Registration Form

NAME:

REG. No.:

PHONE:

EMAIL:

GENDER:

PORTFOLIO:

DEPARTMENT:

YEAR OF ENTRY:

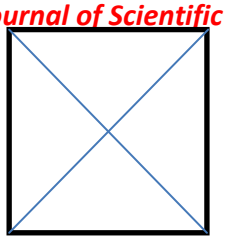
YEAR OF GRADUATION:

PASSWORD:

FIGURE 6: Voter Registration Form

2.3 OUTPUT SPECIFICATION

In an output specification, we try to understand a voter's needs and expected outcomesregarding service levels, quality and frequency. On this basis, we design the best-fitted service solution for the voters. In other words, we focus on the result of the services (the output) rather than the number of people and hours (the input). Working with production allows you to 'think out of the box' and create a much more flexible, cost-efficient and value-added service solution for the benefit of the voter.

PASSPORT: 

NAME: XXXXXXXXX XXXXXXX XXXXXXX
REG. No.: XXXXXXXX/XXX
PHONE: XXXXXXXXX
EMAIL: XXXXXXXXXXXX@XXXXXX.XXX
GENDER: XXXXXXX
PORTFOLIO: XXXXXXXX XXXXXX
DEPARTMENT: XXXXXXXXXXX XXXXXXXX
YEAR OF ENTRY: XXXX
YEAR OF GRADUATION: XXXX
PASSWORD: XXXXXXXXX

FIGURE 7: Aspirant Registration Form

NAME: XXXXXXXXX XXXXXXX XXXXXXX
REG. No.: XXXXXXXX/XXX
PHONE: XXXXXXXXX
EMAIL: XXXXXXXXXXXX@XXXXXX.XXX
GENDER: XXXXXXX
PORTFOLIO: XXXXXXXX XXXXXX
DEPARTMENT: XXXXXXXXXXX XXXXXXXX
YEAR OF ENTRY: XXXX
YEAR OF GRADUATION: XXXX
PASSWORD: XXXXXXXXX

FIGURE 8: Voter Registration Form

DATABASE DESIGN

TABLE 1: ASPIRANT TABLE

S/NO	FIELD NAME	DATA TYPE	LENGTH
1.	NAME	VARCHAR	100
2.	REG. NO.	VARCHAR	50
3.	PHONE	VARCHAR	12
4.	EMAIL	VARCHAR	150
5.	GENDER	VARCHAR	20
6.	DEPARTMENT	VARCHAR	100
7.	PORTFOLIO	VARCHAR	100
8.	YEAR OF ENTRY	VARCHAR	10
9.	YEAR OF GRADUATION	VARCHAR	10
10.	PASSWORD	VARCHAR	20
11.	PASSPORT	VARCHAR	100

TABLE 2: VOTER TABLE

S/NO	FIELD NAME	DATA TYPE	LENGTH
1.	NAME	VARCHAR	100
2.	REG. NO.	VARCHAR	50
3.	PHONE	VARCHAR	12
4.	EMAIL	VARCHAR	150
5.	GENDER	VARCHAR	20
6.	DEPARTMENT	VARCHAR	100
7.	YEAR OF ENTRY	VARCHAR	10
8.	YEAR OF GRADUATION	VARCHAR	10
9.	PASSWORD	VARCHAR	20

TABLE 3: PORTFOLIO TABLE

S/NO	FIELD NAME	DATA TYPE	LENGTH
1.	ASPIRATION PORTION	VARCHAR	100

TABLE 4: VOTE RESULT TABLE

S/NO	FIELD NAME	DATA TYPE	LENGTH
1.	NAME	VARCHAR	150
2.	REG. NO.	VARCHAR	50
3.	ASPIRANT POSITION	VARCHAR	100
4.	VOTE RESULT	VARCHAR	100
5.	PASSPORT	VARCHAR	100

2.4 SYSTEM DESIGN APPROACH

The system is designed using Android Studio, Java Programming Language, and Mysql for the database. It only runs on Android Operating System.

2.5 INTERACTIVITY

The application aims to create an environment for the user to be actively engaged during the visit or use, as the case may be, thereby improving their user experience.It's an interactive application that requires a user to input recommended data to yield outputs

2.6 REUSABILITY AND PORTABILITY

Reusability is the use of existing assets in some form within the software product development process; these assets are products and by-products of the software development life cycle and include code, software components, test suites, designs and documentation.

Portability is an application's ability to be portably installed, deployed, accessed and managed - regardless of delivery model. The term defines an application's flexibility when used on multiple platforms or instantly accessed from the Internet, a desktop or a network.

From the above definitions, the mobile voting application is portable and reusable.

2.7 SECURITY

The most secure part lies in securing the vote cast by the user. To avoid fraudulent voters, the registration number uniquely identifies the user. A voter is not allowed to vote for a position twice. A forgotten password is also retrievable by the user.

a. The voting application only communicates authentic and unaltered voter information.
b. The voting does not store any information which could link the voter with his vote after the completion of the voting process. Where any information which could connect the voter to his voice is stored on the voting server, it shall only be accessible to those with the appropriate authority.
c. The voting application can be recovered in case of system failure.
d. The voter-side voting software ensures that its operations and data are unaffected by other applications running on the mobile device.
e. The voter-side voting software only communicates with authentic and unaltered voter information.
f. The voter-side voting software protects the voter's identity during the voting process

2.8 SYSTEMS REQUIREMENT

2.8.1 Hardware Requirement

A Mobile Phone

2.8.2 Software Requirement

Android Operating System
Mobile Voting Application

3. RESULTS AND DISCUSSION

The mobile voting application will act as a client/server application. A user can vote using the application installed on his "android" Smartphone. This system comprises a Mobile Client Application, Server Application, Web administration panel and a central database. The programming for this application is based on Android Studio, Java, and MySQL.

Droid Volley is an HTTP library that makes networking for Android apps easier and most importantly faster response received is converted to JSON format that can be read by the Android system. It connects to the server application using the volley library and requests voting data. The server application queries the Central database and sends the data to the Mobile Client Application. The user is presented with a screen where they can choose the desired candidates. Once the user has voted, the data is transferred to the server application, which 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 NILEST are allowed to vote in the election. This work aims to design and implement a mobile voting application for the Android platform that will enable people to vote securely from anywhere. The application as a package aims to be compatible with devices running different Android operating system versions. The web administration panel is connected to the central database where the administrator can add new applicants, delete an old applicant, and view voting statistics. Moreover, a student can see the voting results provided he has already voted.

3.1 SYSTEMS DEVELOPMENT

The application is aptly named the Android mobile voting application. It is built using Android development tools. Because of the widespread availability of Android devices and phones, testing on live applications will also be possible. Two other essential tools used are JavaScript and MySQL database; the laptop used to implement our project has the following upcoming configurations: Intel R Core TM i3 CPU M 370 @ 2.40GHz, RAM - 4GB, Hard Disk - 500 GB. The mobile phone used to develop the application is as follows: Mobile Android 4.2.2 Jelly Bean, Processor Quad-core 1.9 GHz Krait 300, RAM-2 GB. The software used in this work are Windows 10 Home 64bit, IDE Eclipse Kepler 4.3.2, Android SDK, Notepad++ 6.8.8, and Microsoft Visio 2017.

3.2 SYSTEMS IMPLEMENTATION

This project, Design and Implementation of an Android Mobile Voting Application, details the requirements needed to implement a mobile voting System using the Android operating system (developed using Android Studio) to run the application and MySQL as a database for storage of voter's information and tested using a mobile phone that Runs Android version of the operating system.The framework describes how smartphones (Android Mobile Operating Systems) are valuable and efficient devices for voting. The framework uses the technology available to many voters (Mobile Phones) and the technological infrastructure exposed to them.

3.3 INTERFACE FORMS

NILEST SUG

FIGURE 9: Application Display On The Mobile Phone

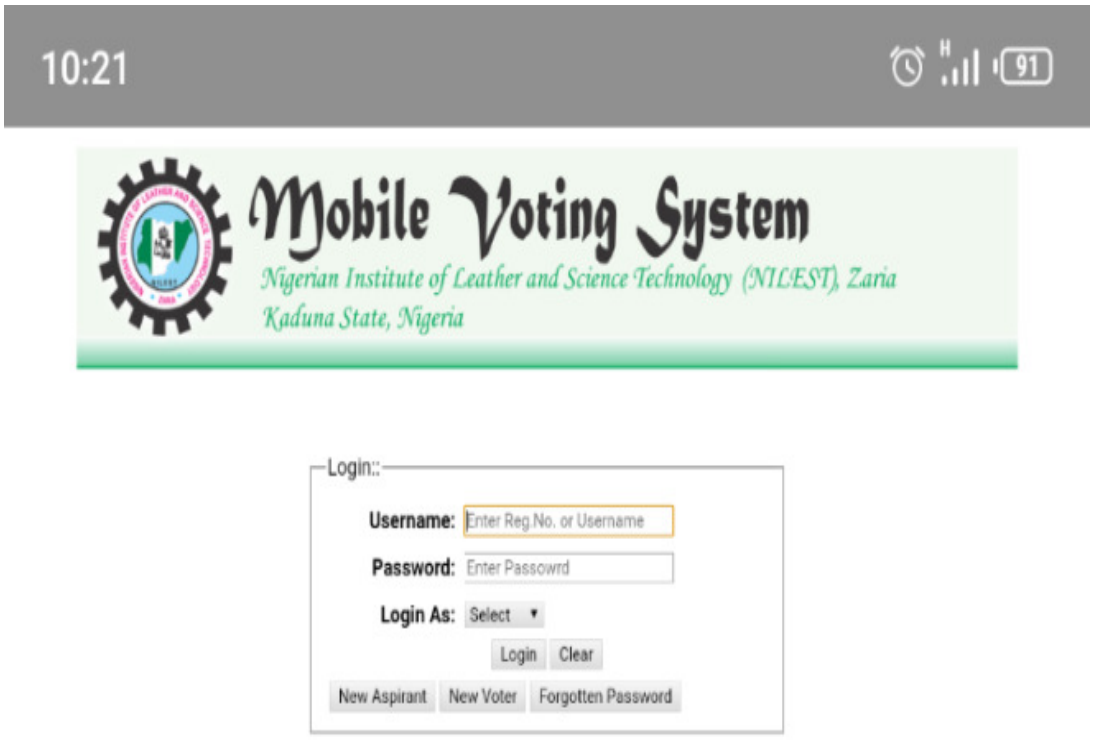


Figure 10: Login Page

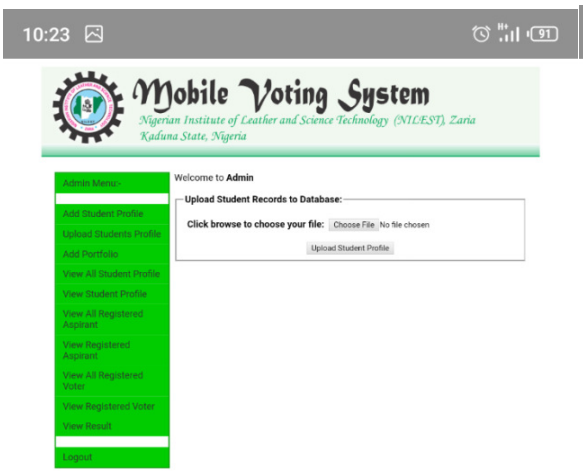


FIGURE 11: Admin login

FIGURE 12: Uploading of Eligible SUG Members

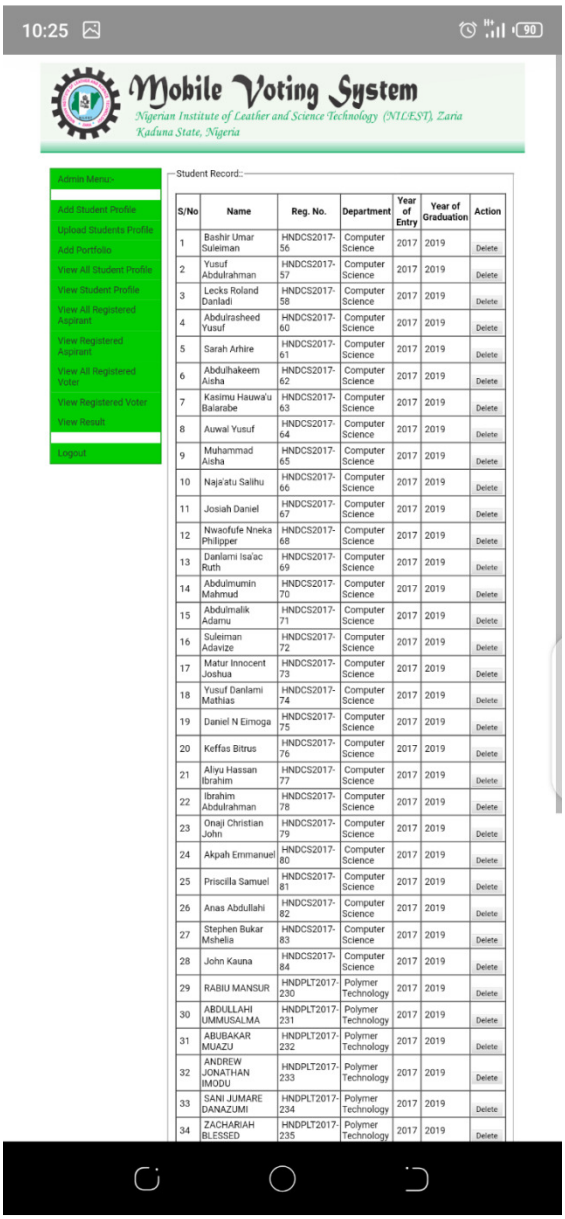


FIGURE 13: List of Eligible Voters

FIGURE 14: List of Portfolio

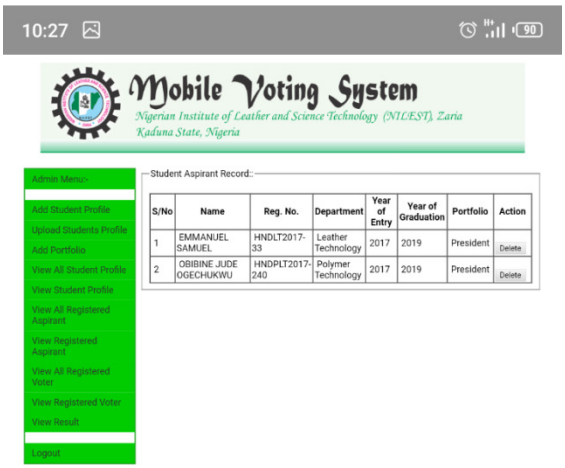


FIGURE 15: Aspirant Records

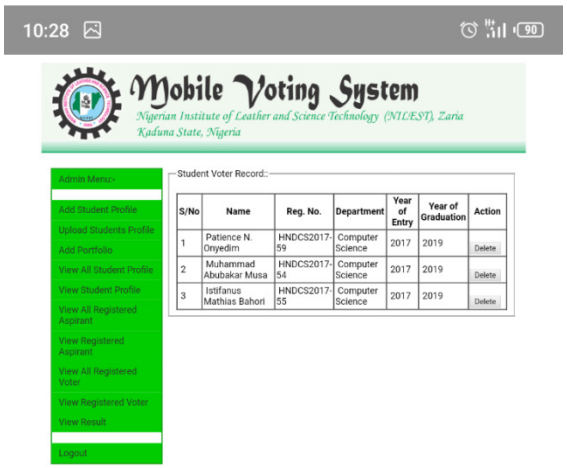
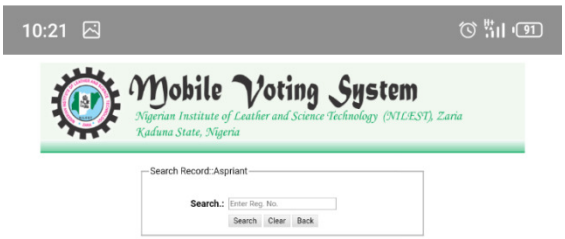


FIGURE 16: Voter Records



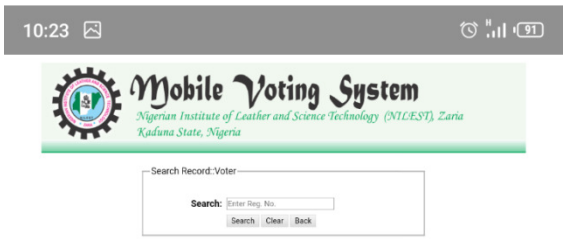
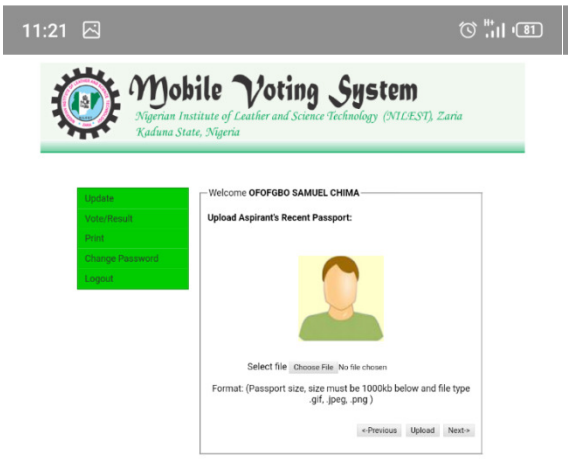


FIGURE 17: Search for Eligible AspirantRecords

FIGURE 18: Search for Eligible Voter Records

FIGURE 19: Update Aspirant Record

FIGURE 20: UpdateVoter Record



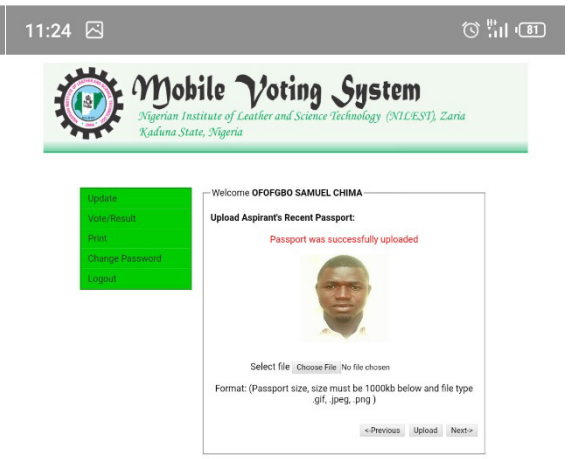


FIGURE 21: Update Aspirant Passport **FIGURE 22: Aspirant Updated Passport Successfully**

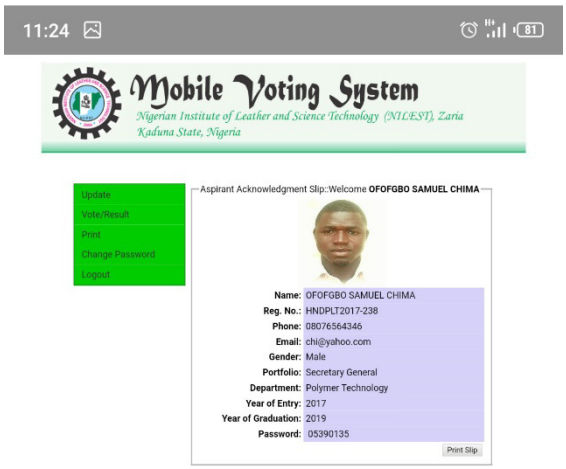


FIGURE 23: Aspirant Print-Slip

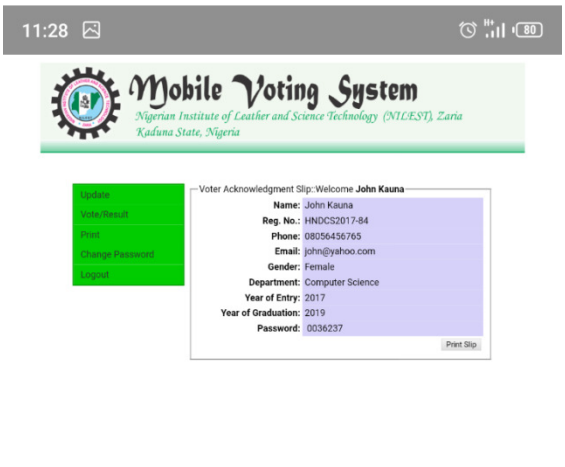


FIGURE 24: Voter Print-Slip

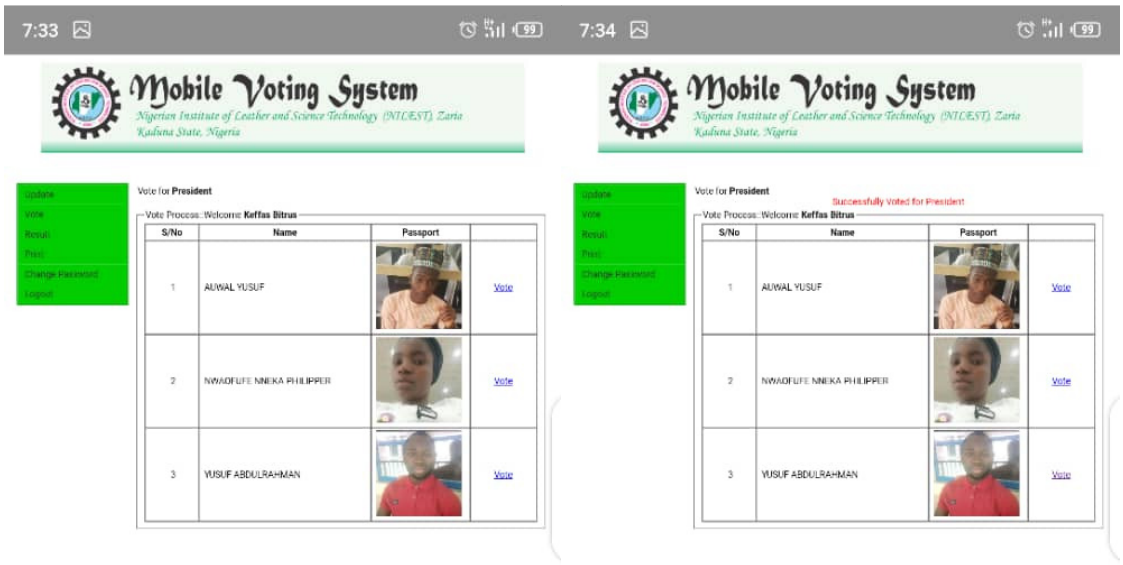
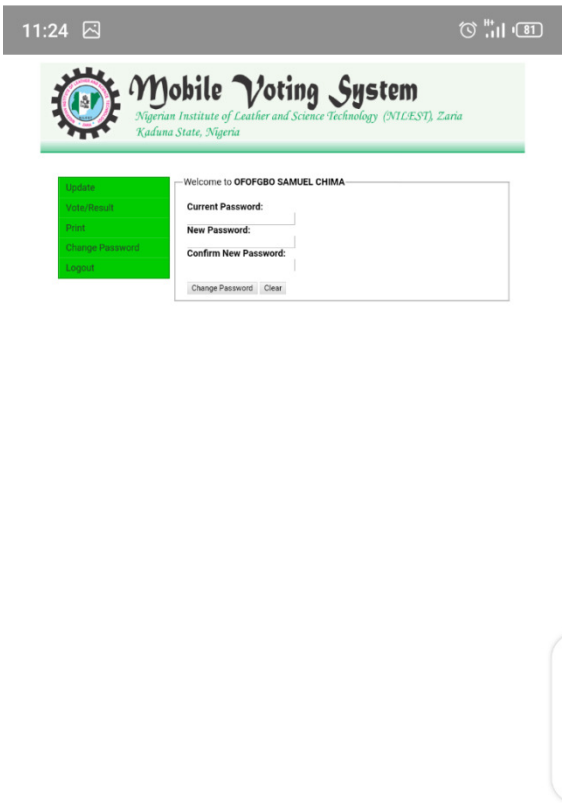


FIGURE 25: Voting Process **FIGURE 26: Voter Voted Successfully**

FIGURE 27: Voter Result View Page

FIGURE 28: Admin Result View Page



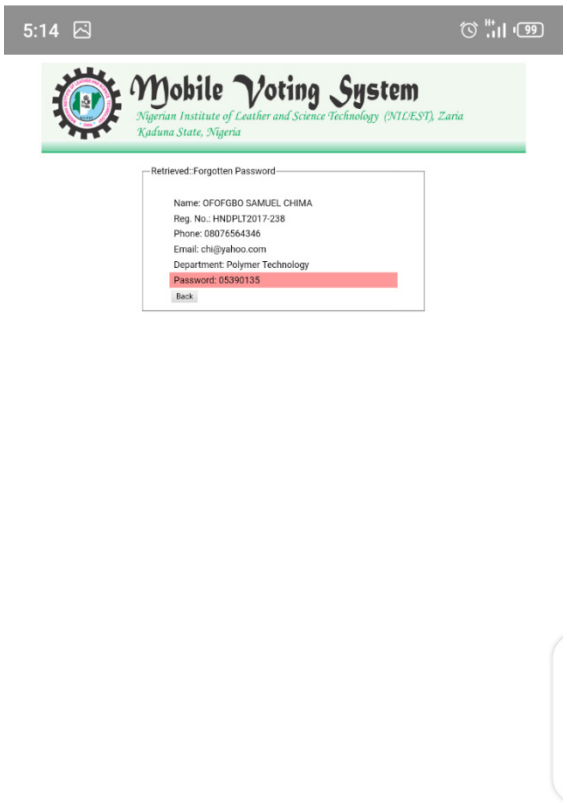


FIGURE 27: Change Password Page

FIGURE 28: Recovered Forgotten Password

3.4 USER GUIDE AND DOCUMENTATION

The mobile voting system consists of three layouts: Admin login, aspirant login, and voter login. If the voter has been previously registered by the admin, in addition to his unique verification ID, which can be his voter ID, he will also be allocated a password. This information will be stored in the VOTER table of the databasefor every registered voter. During login, the voter must enter said user ID and password. This will be cross-checked with the database,and if matched, the voter can cast his vote.

I. Administrator:

The administrator can log in using a pre-existing username and password. Logging into the application as the administrator unlocks certain functionalities which can be selected to proceed. The admin functionalities are explained below.

a. For creating a voter: When selecting this option, the application asks the admin to enter voter details, i.e. Name and Verification ID. If the fields are filled appropriately, the voter is registered in the database, and the application window displays the generated Voter ID and password. This information is also stored in the database to facilitate login.
b. For viewing the results: When this option is selected, the list of candidates and the total number of votes each receives is displayed. The admin can consider this to determine the candidate with the highest votes. The mapping of voters to candidates is not visible even to the admin to allow complete privacy.
c. For listing the voters: The admin must hold a record of all registered voters in a database. This information will be displayed on the selection of this option. Voter data, including name, verification ID, user ID and password, will appear for every registered voter on the screen.

II. Aspirant:

The aspirant column will contain the names of all eligible candidates and the total number of votes for each candidate. The number of votes will be incremented when a user votes for that candidate.

III. Voter:

The admin must first register the voter. Once the registration is complete, the voter can log in using the automatically generated user ID and password. Once logged in, a list of candidates will be on the screen. The voter must select one of them to vote for. Once a vote is cast, a confirmation dialogue appears to ensure that the selection was successful. Finally, the vote is accepted, and the tally for that candidate is incremented in the database.

4. CONCLUSION

Mobile Voting Application has been successfully developed and tested locally. The methodology specified has been followed duly in the development of the system, and more importantly, the set objectives have been achieved. By using the system, the Students union will observe a more transparent, credible, and free and fair elections, also Setting up election schedules have been made easier by the system. A user can only vote once, which is a great accomplishment.

A mobile voting system will be an inexpensive and less time-consuming alternative to existing electronic voting systems.

5. RECOMMENDATION

a. Different users use different mobile platforms. Therefore, future development should focus on developing a better system operating on other platforms such as iOS, Blackberry and Windows.

b. Newer releases of Smartphones have fingerprint scanners built into them which can be a resource for voter authentication. Other biometrics, like retina scans, can be integrated with the system by making the appropriate hardware and software additions.
c. Facial recognition software can be used for the same reason. There is an enormous scope for customization and enhancement of aspects of the system to meet specific needs.

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