



A Web-Based Parent-Teacher Collaborative System for Monitoring Students' Academic Performances in Nigerian Schools

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Abstract

Parents play vital roles in contributing to students' achievement. They need to be actively involved in monitoring their children's daily performance in school. This thesis focused on the design and implementation of a web-based system for engaging teachers and parents in monitoring students' performance. It is aimed at providing a well-designed platform for real-time communication between teachers and parents with respect to children's daily performance in school. A discussion on the analysis of the existing system was made, and a proposed system was designed. The new system designed will go a long way in reducing the time it takes for parents to access their children's reports in school. It creates a community-like environment where teachers and parents can interact based on the activities of the students in school. The methodology adopted for this thesis was Object-Oriented Hypermedia Design Methodology (OOHDM). It was implemented using the Python programming language and Django Framework was used as the database tool.

Subject Areas

Web-Based Application

Keywords

Traditional Education, Classroom, Educational Software, Web-Based System

1. Introduction

Communication is an essential part of everyday life. It is generally regarded as an essential part of the inner workings of any organization, school and eventually at

home (Ismail *et al.*, 2019) [1]. Communication nowadays integrates technology and information technology in particular that lots of new communication services, systems, protocols and devices to help ensure that people are communicating in the most effective and efficient way. Sharing, storing, retrieving and communicating information almost anywhere can be done rapidly (Joshi *et al.*, 2013) [2]. In school, communication is very important to achieve a student's better education, future personal and professional success. The entire thing that occurs within a school and particularly in the classroom comprises communication which is the act of sharing information. It is the medium for instruction, assessment, interpersonal relationships, group interactions, community, parent relations and counselling. The better the communication is in a teaching environment, the more enhanced the learning will be. However, most behaviour problems in school and their solutions comprise some type of communication (Khan, *et al.*, 2017) [3].

When there is a failure in communication, things start to wander and become disordered. The same is true for teachers who are having difficulties in dealing with their students due to insufficient parents' involvement wherein one of the categories of parent involvement identified by Epstein is communication (Althea, 2019) [4]. The education of students is a shared responsibility, benefiting all students. Therefore, parents and teachers have a joint responsibility to collaborate in school to guide and support their students. We know that schools are better able to support students' achievement by developing strong engagement with and between parents and teachers. Communication between home and school aids a teacher in understanding a student better, which lets the teacher find ways to teach them more effectively (Hurst, Wallace & Nixon, 2013) [5]. Furthermore, teachers are using technology most effectively to improve their teaching and increase student learning. Through the use of technology, schools can provide tools that allow parents and teachers to communicate and collaborate efficiently to ensure student's achievement. Moreover, parents will have the opportunity to monitor how well their child/children are doing in school on a daily basis (Patel, 2018) [6].

Computers have taken a prominent role in modern communication. From the smartphones in our pockets to the smart devices controlling our appliances at home and everything in between, computer technology is everywhere. The use of computers in education has been steadily increasing and in many ways has revolutionised traditional education (Sword, 2021) [7]. Computers in the classroom have multiple benefits for both students and their teachers. They are amongst the most valuable resources in the classroom because they serve so many useful functions. Computers have revolutionised the teaching profession in multiple ways. Teachers use computers to record grades, calculate averages, manage attendance and access data on students' performance in online programmes and assessments. The evolution of the internet has given rise to many online-based technologies and the computer is the fundamental machine (Peña-López, 2016) [8].

Monitoring children's progress in academics and other extracurricular activities is vital to ensuring the attainment of set goals and objectives in education (Lin, Wang & Lee, 2022) [9]. The methods used in evaluating children's progress in academics and extracurricular activities are inefficient in most Nigerian schools. Worse still, the engagement of parents in the monitoring of students' progress in school is at its lowest level. This is due to the fact that many schools and parents do not attach importance to this role, thereby making the parents not be abreast of their children's activities and performances in school (Dotson, 2016) [10].

This study aimed at the design and implementation of a web-based system for engaging teachers and parents in monitoring students' performance.

2. Related Work

Technology creates opportunities to directly link home and school. In other words, technology may foster effective communication between teachers and parents as well as transform the role and status of homework which eventually extends learning opportunities. In addition, technologies which are flexible, accessible and provide interactive resources may facilitate and support parents' engagement in their child's learning process (Collins & Halverson, 2018) [11]. In this study, several technology-based approaches and similar existing systems developed to support communications among teachers, students and parents are reviewed (Baquedano-López, Alexander & Hernández, 2013) [12]. These systems fall in the categories of Sportal, social media and mobile application.

Tamayo and Lim (2017) [13] developed a collaboration system for teachers, parents and students that will be used to monitor the performance of the students. The prototype system is a web-based type of application and deployed on a cloud-based server for an efficient and cost effective implementation. The developed system is a web-based program that uses open source application/language developing tools like PHP, HTML, CSS, Ajax and JQuery. These are all open source software that are well known and advance web-based development tools nowadays. The system runs on different environments due to its multi platform front-end (Interface) and back-end (Database). The whole system was developed on both the front-end and back-end. MySQL was used for the back-end deployments for the database of the system. The entire system was hosted in the cloud server facility for efficient operation and cost effective service. The system is accessible in any updated browsers such as Google Chrome, Firefox, Safari, Opera, and Internet Explorer. The system can also be accessed on mobile and tablet devices due to its responsive web design.

Ya'acob *et al.* (2018) [14] designed a Web-Based Boarding School Monitoring System to solve the problem of inaccurate logging, time, misplacement of outing cards and an unorganised log record of manual systems. This technology offers a system that can record student log data in an accurate manner. The aim is to build a system that can provide accurate data to parents and teachers via a single

click through their personal device. This system uses RFID module technology to monitor the student's log activity in a real time manner. The monitoring system involves the utilisation of Arduino Mega, Ethernet Shield, Global System for Mobile communication (GSM) and Radio Frequency Identification (RFID) Module. The system performs an automated data log after the student flashed their card to the RFID reader, the data is uploaded to the database after the card has been flashed and the uploaded information can be viewed at the webpage at any time and from anywhere.

Razak, Abdurahim and Mashhad (2016) [15] developed a system for keeping parents involved using 360-class monitoring applications. This application was developed using Java programming language, Android Studio, Java Development Kit (JDK), GenyMotion Emulator and SQLite as well as Structured Query Language (SQL). A menu-based navigation approach was applied for flexible and easy navigation. Teachers are able to create, edit, and post homework descriptions for parents and students to view.

3. Materials and Methods

The methodology adopted for the proposed system is Object-Oriented Hypermedia Design Methodology (OOHDM). This is a model-based approach for building large hypermedia applications. It has been used to design different kinds of applications like: websites, information systems, multimedia presentations, etc. OOHDM comprises four different activities namely:

- Conceptual design
- Navigational design
- Abstract interface design and
- Implementation

3.1. Analysis of the Proposed System

The proposed (new) system is based on engagement of Form Teachers and parents on a web-based platform towards child's development.

The data flow diagram of the proposed system is depicted in **Figure 1**. Admin, Teacher, and Parents are the external entities of the system that interact together. The progress report and feedback are the data flows that serve as collection of several pieces of information. Creation of entitlement and granting of access by the Admin, and feedback are activities that are performed for some specific reasons.

It allows an Admin to create accounts and grant entitlements to form teachers and parents on the platform. The form teacher uploads student's progress report, which includes academic performance and participation in other activities going on within the school environment. The report can then be viewed online by parents who can only access a child's report using his/her personal data on the system, using any Internet enabled device. The parents can also make their comments through the same medium.

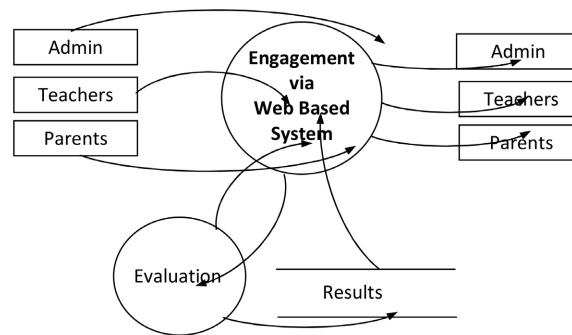


Figure 1. Data flow diagram of the proposed system.

Class diagram was also used to model the proposed system. A class diagram describes the static structure of a system. It shows how a system is structured rather than how it behaves. The static structure of a system comprises of the system's classes, their attributes, operations (or methods), and the relationships among objects. In **Figure 2**, the following classes are depicted:

- 1) Teacher class
- 2) Parent class
- 3) Admin class

Each class contains various attributes and methods (Functions) which call other class attributes to share data.

1) Teacher class contains attributes such as Evaluation report and Comment, and functions such as fill_studendailyreport, view_studentdailyreport, make_comment, and upload_studentreport.

2) Parent class contains attributes such as Feedback and Comment, and functions such as view_studentdailyreport, and update_profile and make_comment.

3) Admin class contain attributes such as Account creation and approve report, and functions such as create_user, set_password, create_staffuser, create_superuser and student_image.

In **Figure 2**, the Admin creates different users on the platform and assign roles to them according to their specified class. The teacher evaluates the students, make his/her comments and upload their reports on the engagement platform. The parent can view the report on each student, as uploaded by the teacher, and make his/her comment which serves as feedback to the teacher.

Use case diagram was also used in the modeling of the new system. The use case diagram is representation of the systems intended functions and its environment. Intuitively, use cases represent the different ways in which a system can be used by the users.

The purpose of a use case is to define a piece of coherent behavior without revealing the internal structure of the system. The use cases do not mention any specific algorithm to be used or the internal data representation, internal structure of the software, etc.

The use case diagram for any system consists of a set of use cases, actors and system boundaries. All the *actors* are represented by little stick figures; all the

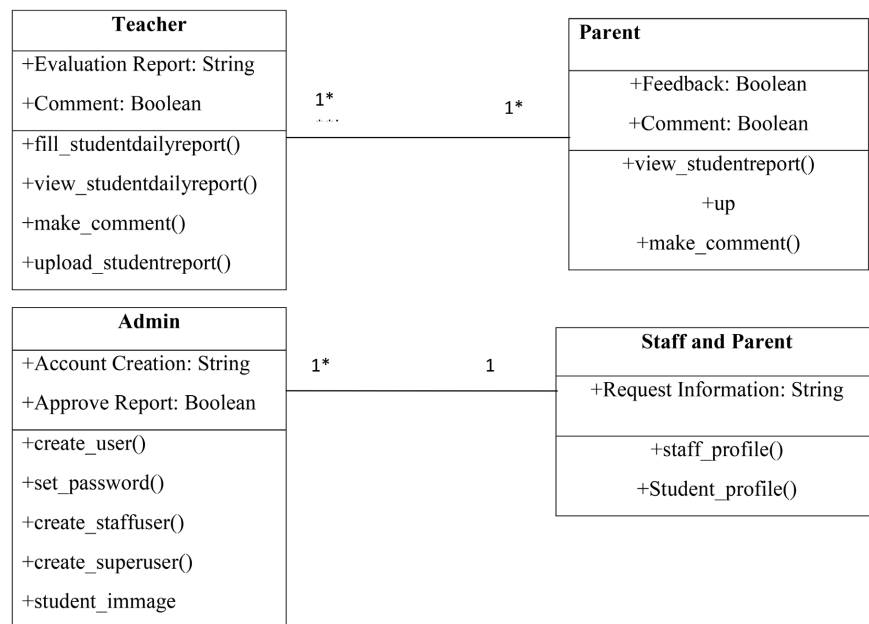


Figure 2. Class diagram of the proposed system.

actions are represented by ovals and are called *use cases*. The actors and use cases are connected by lines. Very often there is also one or more system boundaries. Actors, which usually are not part of the system, are drawn outside the system area.

Figure 3 shows the Use Case diagram of the new system. Here, the administrator (Admin) will be able to login with his/her details, create accounts for teachers and parents using teachers' details and students' details respectively. The admin can also staff and students' information, view teachers' and parents' reports on students' performance, teachers' and students' profile and log out of the system.

Teachers will be able to login with their details, select the particular session, term, class and lesson period they want to report on. Next, they select students whose records are to be filled and uploaded, fill the records, make their comment and click on the submit button to upload the students' report. The teachers can also view parents' comments on students' report. They can also change their login password if they so wish.

Parents will be able to login with children's details, view report on their children's performance, including the teachers' comment, and make their own comment on the report, which may include a response to the teachers' comment. Parents can also update their children's profile and change their password before login out of the engagement system.

Activity diagram was also used in the modeling of the new system. An activity diagram visually presents a series of actions or flow of control in a system similar to a flowchart or a data flow diagram. It usually has a beginning or initial state and an end or final state.

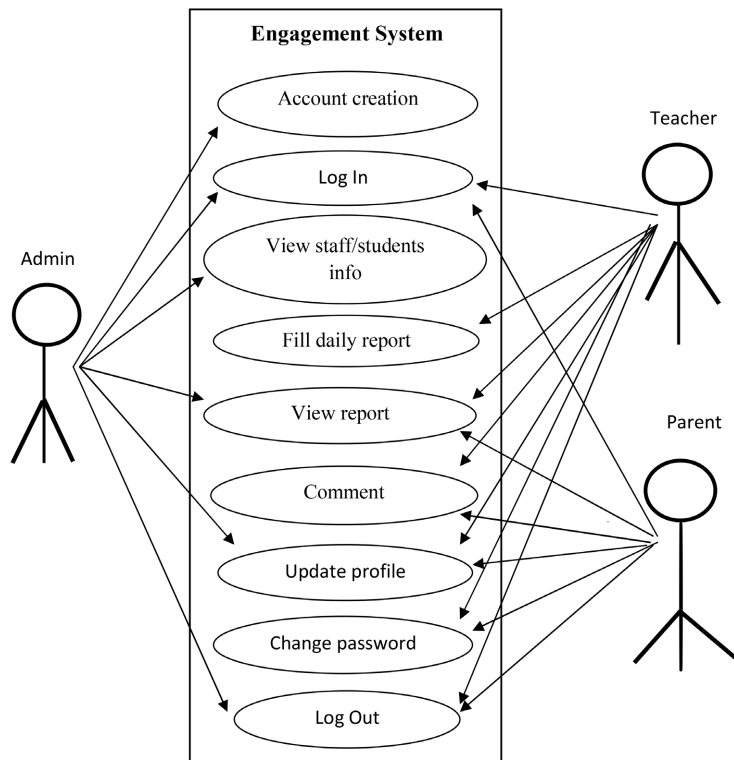


Figure 3. Use case diagram of the proposed system.

Figure 4 shows the activity diagram of the new system. The activity diagram of the new system shows the steps involved in designing the web-based system intended to engage teachers and parents in monitoring students' performance. The system starts by creating user account and its types (admin, teacher or parent). If this process is successful, the user is prompted to put in login details, usually registration number and password, through a central login system. If the correct password is entered the admin/teacher/parent will have access to their displayed menu respectively. The admin has the options of adding/deleting users to the platform, view user's profile, update profile and/or view student's report. The teacher will have the options of selecting a student, fill student's report, comment on students report, and upload the report. The parent will be able to access student report and comment on the report.

3.2. Advantages of the Proposed System

Parents are more likely to be actively involved in their child's education when they feel a part of the school. And when parents are part of the school and actively involved, the teachers feel as though they are appreciated. Furthermore, when there is a sense strong community, students are more likely to achieve.

Currently, most schools, families, and communities have heavily relied on physical progress report, and physical security of surveillance, which do not involve forms of computer technologies. This engagement system will create an efficient, cost effective and real time virtual school community where teachers,

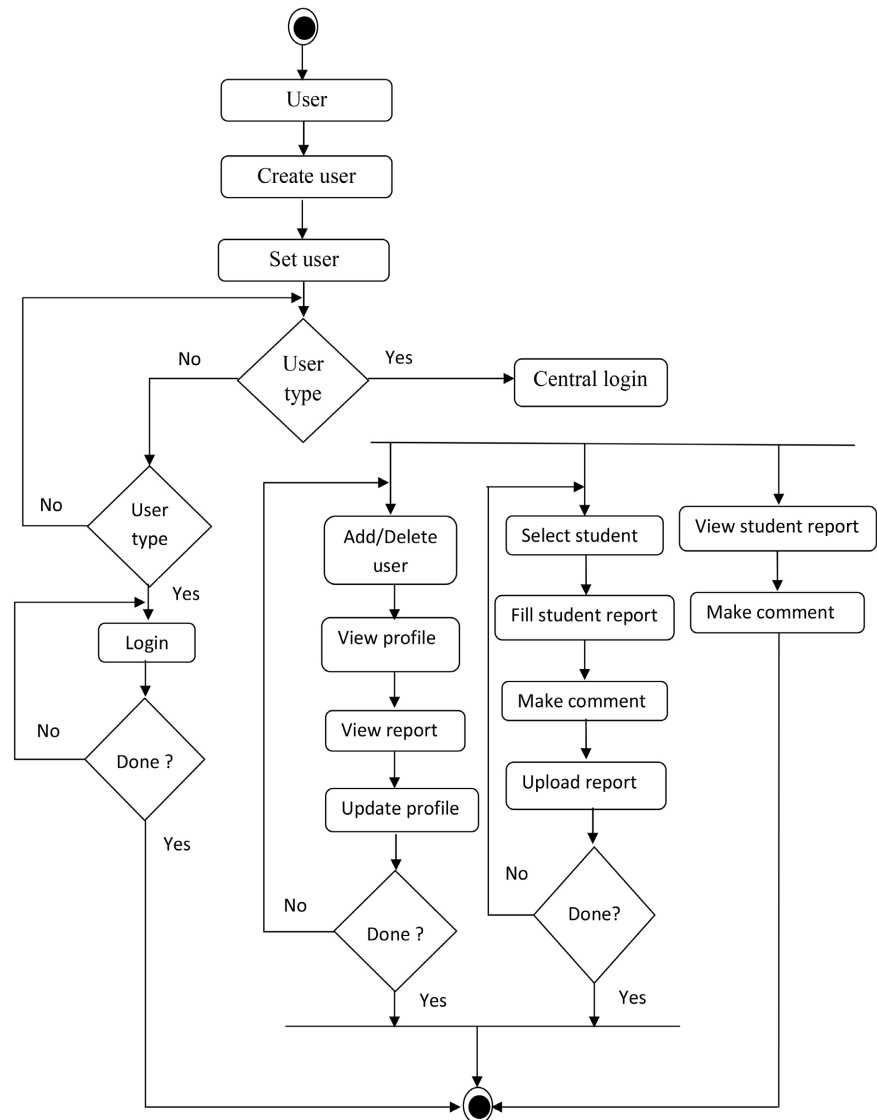


Figure 4. Activity diagram of the proposed system.

parents, and other stakeholders will collaborate to work and play their important roles in the upbringing of their children. In addition, the system will make parents be in the know about their child's activities in school anytime and anyplace, thereby justifying the proposed system.

3.3. High Level Model of the Proposed System

High level models are simple models with the primary goal to support understanding, analysis, communication and decision making (Muller, 2020) [16]. The models have different complementary representations and formats, e.g. visual diagrams, mathematical formulas, and quantitative information and graphs. The models are made at different levels to guide software design choices: enterprise level, specification level, and design.

The high level model of the proposed system is depicted in **Figure 5** below:

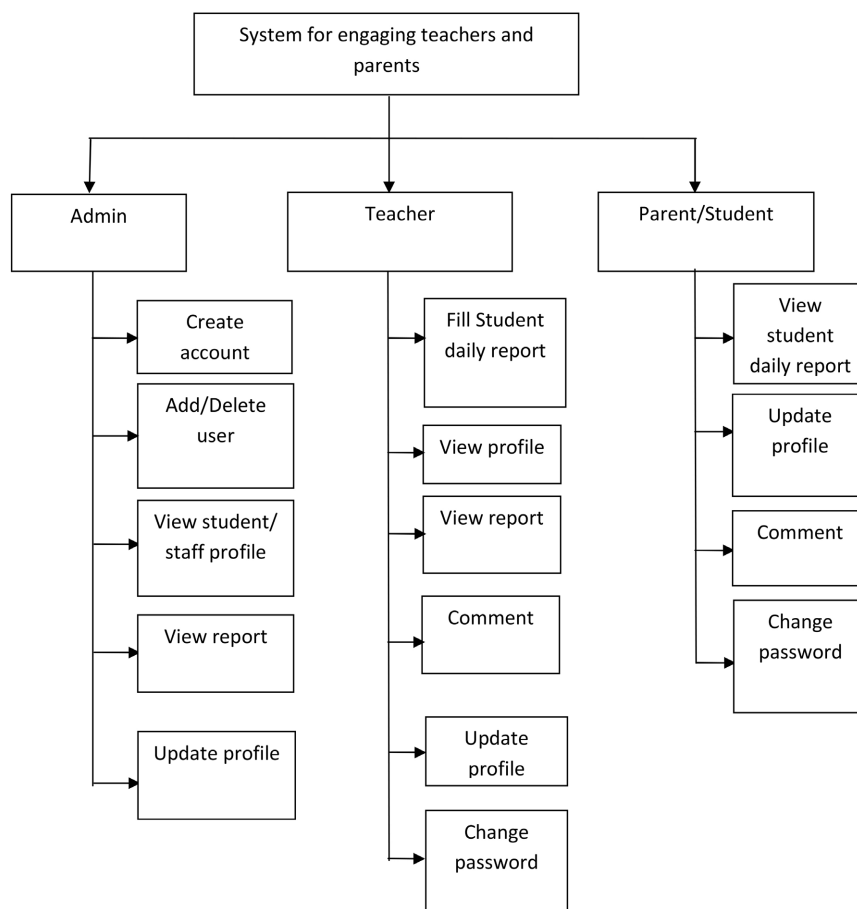


Figure 5. High level model of the proposed system.

3.4. Control Centre/Main Menu

The main menu describes the actors that are found in the proposed “web-based system for engaging teachers and parents in monitoring students performance”, where each actor is described with their privileges. The Main Menu is categorized into three modules: The Administrator (Admin), Teacher and Parent as shown in **Figure 6**:

1) Admin: this is a person or group of persons with the responsibilities of Authentication and Authorization (Creating user, Granting access to user, creating user’s privilege on data).

2) Teacher: This is a person or group of persons that prepare and upload students’ daily reports. It is also their responsibility to make comments on students’ reports and respond to parents’ comments.

3) Student/Parent: This is a person or group of persons responsible for viewing students’ progress reports. They also make comments on those reports.

3.5. The Submenus/Subsystems

In this research, each main menu was broken into different sub menus so as to describe in detail what is being done in each menu in **Figures 7-9**.

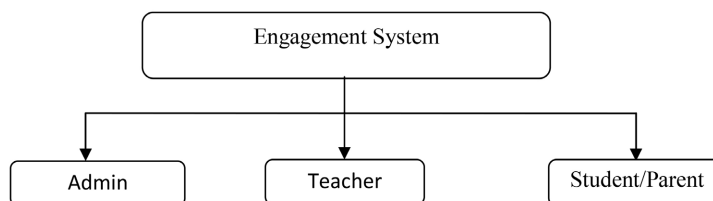


Figure 6. The control centre/main menu.

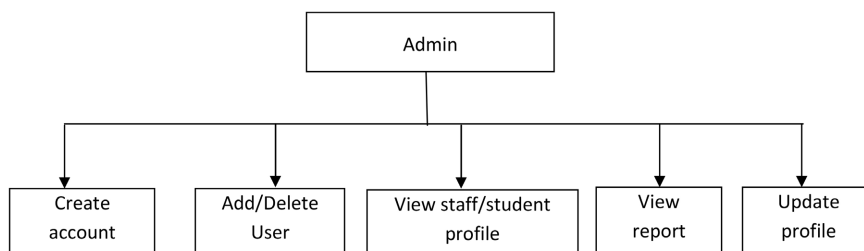


Figure 7. Submenu of the admin menu.

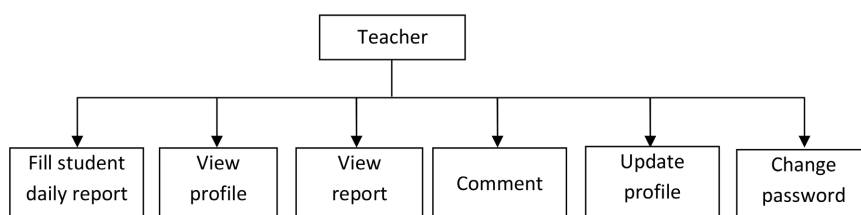


Figure 8. Submenu of the teacher menu.

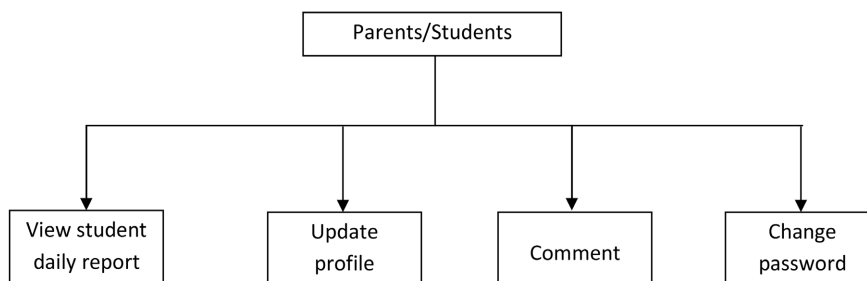


Figure 9. Submenus of the parent/student menu.

1) Admin Sub Menu

- a) Create account: This menu is used to create an account for a user.
- b) Add/Delete User: this is used to add or delete a user as admin, teacher or parent/student.
- c) View staff/student profile: This is used to view the profile of a teacher or parent/student.

d) View report: This is used to view a student's daily report.

e) Update profile: this is used to update a user's profile.

2) Teacher Sub Menu

a) Fill student daily report: This menu is used to fill students' daily reports.

b) View profile: this is used to view teacher's profile.

c) View report: this is used to view a student's daily report as filled by the teacher.

d) Comment: this is used to comment on the student's daily report.

e) Update profile: this is used to update a teacher's profile.

f) Change password: this is used change teacher's password.

3) Parent/Student Sub Menu

a) View student daily report: this is used to view a student's daily report.

b) Update profile: This is used to update a student's profile.

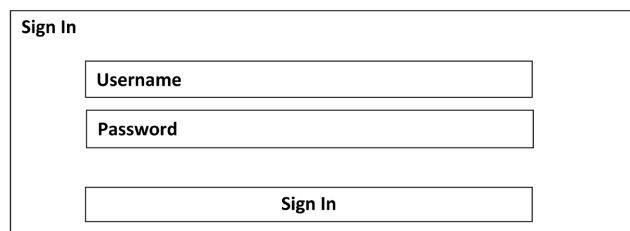
c) Comment: This is used to comment on student's daily report.

d) Change password: This is used to change a student's password.

3.6. Input Format

Central Login Form: This form allows users and the administrator of the system to gain access to the system by supplying their login credentials; it is depicted in **Figure 10** below.

Upload Form for Student's Daily Report: This form allows the teacher to fill and upload a student's daily report; it is depicted in **Figure 11**.



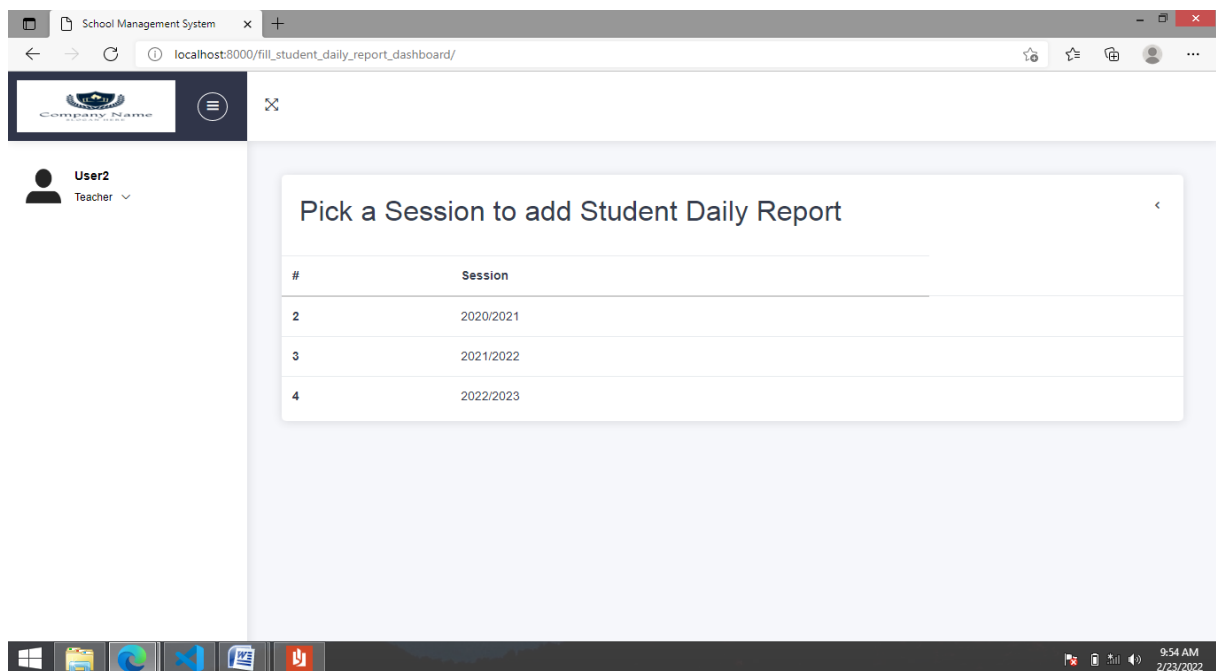
Sign In

Username

Password

Sign In

Figure 10. Central login form.



School Management System

localhost:8000/fill_student_daily_report_dashboard/

Company Name

User2
Teacher

Pick a Session to add Student Daily Report

#	Session
2	2020/2021
3	2021/2022
4	2022/2023

9:54 AM
2/23/2022

Figure 11. Upload form for student's daily report.

3.7. Output Format

This refers to the paper specification of how the result from the system will be displayed to end users. The outputs of the system are attached bellow (**Figures 12-14**):

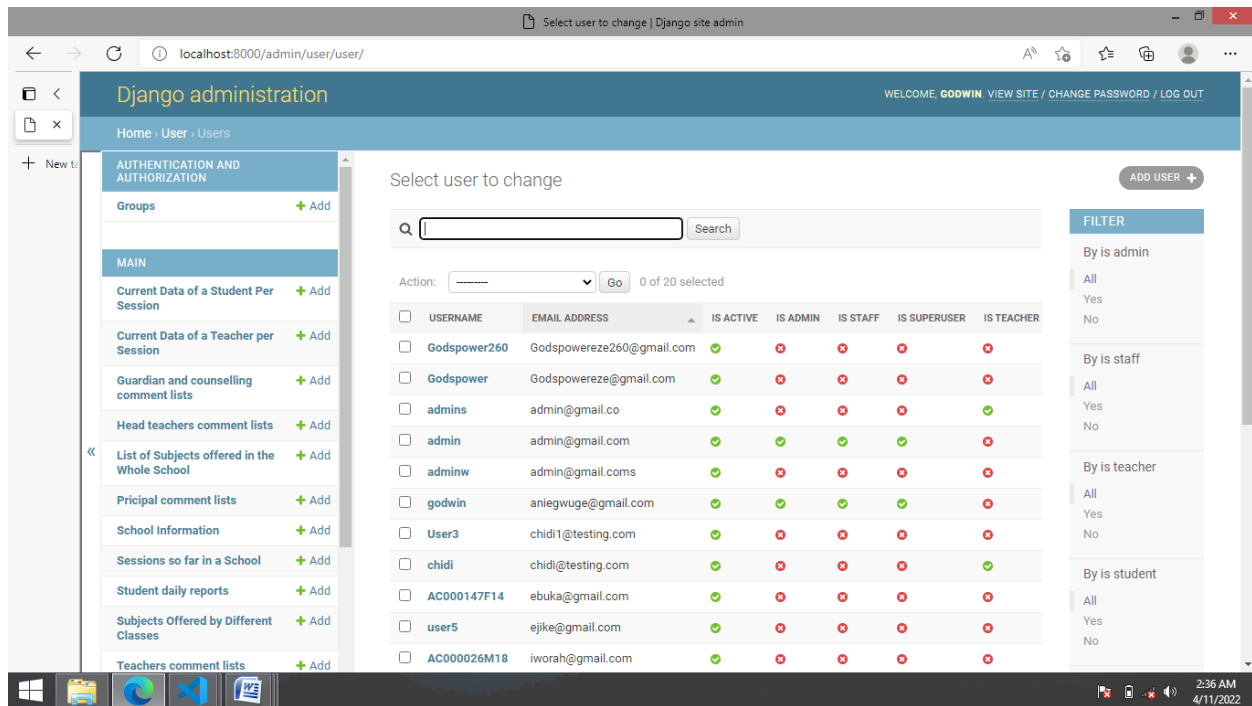


Figure 12. Admin dashboard.

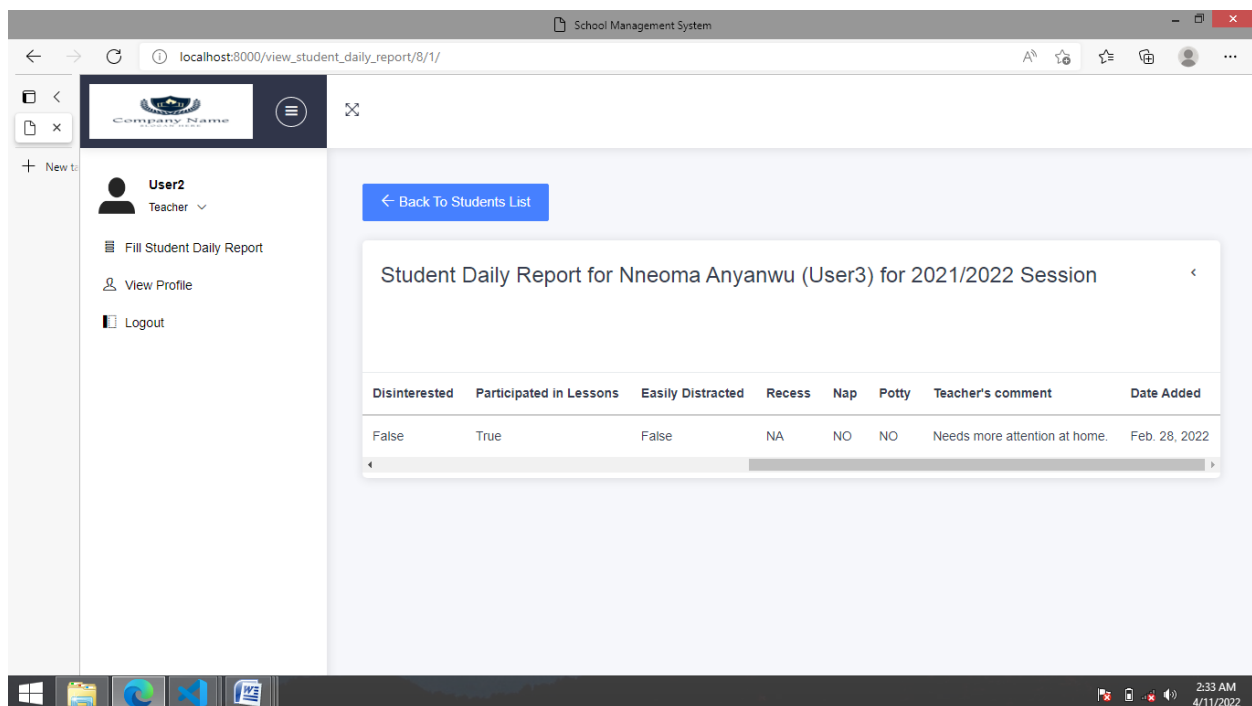


Figure 13. Teacher dashboard.

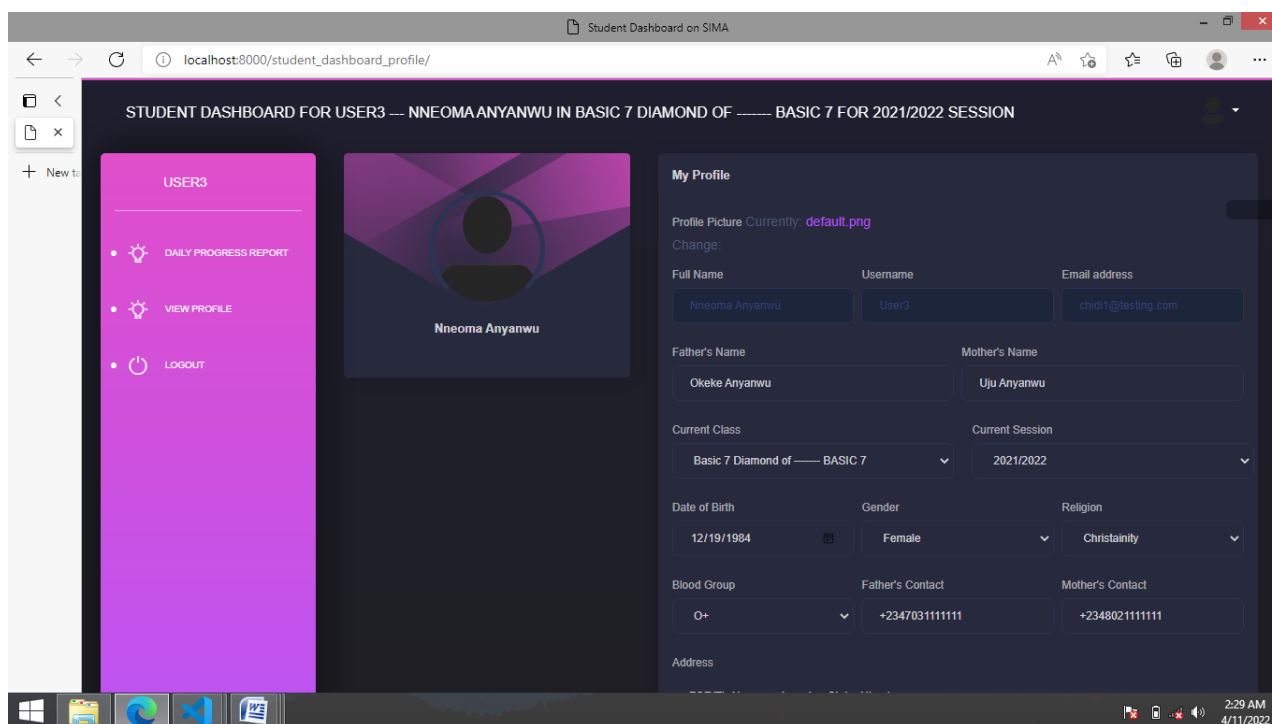


Figure 14. Student dashboard.

4. System Testing

System testing refers to the thorough examination and assessment of a system. It is subjected to ensure that the system is void of errors and bugs. This is an important phase for this new system. After writing the code for the whole programs of the system, a test plan is developed and run on a given set of test data. Testing is the process of analyzing software to detect any defect, differences between existing and required conditions and to evaluate the features of the software item.

4.1. Test Plan

Test plan describes the scope and focus of the testing, how it will be performed, any resources needed, the schedule for the testing activities, and the functionality that will be delivered. This test plan focuses on testing the web-based system for engaging teachers and parents in monitoring students' performance. **Table 1** displays the test plan objective, assumptions and method for web-based system.

Functional Tests: During this functional testing, preloaded data which are available on the system at the time of execution was used for the testing.

Purpose: Functional test was performed to check the functions of the modules.

Testers: Developer

Test Acceptance Criteria: Test environment with application installed, configured and in ready to use state. Test cases developed and approved before test execution.

Timing: After the test is completed

Table 1. Test plan objectives, assumptions and methods.

Test Objectives	Test Assumptions	Method
1) To verify that the functionality of the web-based engagement system sub-modules work according to specifications. 2) To execute and verify test scripts, identify, fix and retest defects	1) The system will be treated as a black box; if the token is generated and transmitted to the display page correctly, it will be assumed that the database is working properly 2) There is no environment downtime during tests due to outages or defect fixes	The tests will be performed according to functional scripts, containing all test cases

Table 2. Sample of actual test result versus expected test result.

Test Case	Expected Test Result	Actual Test Result
To login as the system super admin.	Expected to grant super admin access into the system menu if login details are correct.	Successful login of super admin with correct credentials.
To login as the system admin.	Expected to grant admin access into the system menu if login details are correct.	Successful login of admin with correct credentials.
To view student daily report.	Expected to display to student daily report.	Displayed student daily report.
Update teacher's profile.	Expected to update teacher's profile.	Successful update of teacher's profile.

Scope: The test performed functional testing on Teacher and Parent sub-modules of the system for engaging teachers and parents in monitoring students' performance.

4.2. Test Data

In the functional testing of the Teachers and Parents sub-modules of engagement system, pre-loaded sample data was used for testing purposes.

4.3. Actual Test Result versus Expected Test Result

During execution of the different test cases, the actual results obtained were presented against the expected results. **Table 2** shows a sample of actual test result versus expected result of some test cases executed during the testing of the system.

5. Conclusion

The software was designed and implemented in a fast, easy and error-free way through which teachers and parents can communicate effectively with regard to the students' academic performance. It will save both teachers and parents from

unnecessary stress and time wastage. However, the system can only be accessed through an Internet-enabled device since it works on real-time bases.

Conflicts of Interest

The authors declare no conflicts of interest.

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