ASHESI UNIVERSITY COLLEGE

EDUAPP, AN EDUCATIONAL WEB AND MOBILE PLATFORM

APPLIED PROJECT

B.Sc. Management Information Systems

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EduApp, An Educational Web And Mobile Platform

APPLIED PROJECT

Applied Project submitted to the Department of Computer Science, Ashesi University College

in partial fulfilment of the requirements for the award of Bachelor of Science degree in

Management Information Systems

Brian Martey

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DECLARATION

I hereby declare that this Applied Project is the result of my own original work and that no part

of it has been presented for another degree in this university or elsewhere.

Candidate's Signature:

....

Candidate's Name:

....

Date:

....

I hereby declare that preparation and presentation of this Applied Project were supervised in

accordance with the guidelines on supervision of Applied Project laid down by Ashesi

University College.

Supervisor's Signature:

....

Supervisor's Name:

....

Date:

....

Acknowledgement

To my supervisor, Dr. Nathan Amanquah and the computer science department, I am thankful

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thankful for all the support that you have continued to give me throughout this project.

Abstract

There has been an increase in poor educational performance in the Ghanaian society that has caused many to sort out the root problem. As shown in previous scholarly work, there are many problems that face the Ghanaian education. These can range from stagnating school enrolment, inefficiency of educational administration to teacher training.

One research made a note that some of these problems were long standing while others arose because of the unchanging educational system to reflect changing times. For instance, Ghanaian parents continue to grow more concerned about the relevance and quality of education being provided to their wards.

Another article by Marzano and Pickering found a correlation between homework given and the performance of children. It is believed that with appropriate homework and parent involvement, children were seen to improve. It is with that in mind that I came up with the solution, EduApp.

EduApp provides an assignment approval system that would help parents review their wards submissions. As a mobile and web application, EduApp is geared toward guaranteeing parents the quality of assignments given to their wards is implemented for the Ghanaian context. It is intended to serve as an attendance assessment, assignment distribution, teacher evaluation and student performance overview.

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Chapter 1 : Introduction

1.1 Introduction

Ghana prides itself for having one of the best educational systems within the continent, a pride that, until recently, had been justifiable. From data collected by the United Nations Educational, Scientific and Cultural Organization's (UNESCO) Institute for Statistics, the gross enrolment ratio into the tertiary education has risen over the years but is currently at 15.6%. This is a far cry from the 71.04% enrolment ratio witnessed in the secondary education sector. The question then arises as to what has brought about this situation?

With the great disparity evident within the country, there has been confusion as to why this is occurring. Stakeholders, namely the public and some educational institutions attribute this to the lack of proper supplementary educational materials while others wonder if the teachers involved are to blame. In a report issued by the Ghana Ministry of Education, it was shown that between 2014 to 2015, the textbook-to-student ratio had decreased averagely by 7% to about 56% in secondary institutions (Ministry of Education, Republic of Ghana, 2015). Meaning to every 100 high school students there were about 56 textbooks.

In another report by the same ministry published in May 2015, it was shown that there had been an increase in the number of teachers in the primary and junior high school institutions institutions (Ministry of Education, Republic of Ghana, 2015). They had increased averagely 2.2% in 2015 whiles the growth of students in both levels of education had been by more than 5% in that same year. The above data shows that there is not enough supplementary resources available to these students and also there is great difference between teacher and student ratio.

Another report by Robert Marzano and Debra Pickering discussed the impact of homework versus no homework in the educational system. Their research expanded on many previous

research performed and summed up those results. Their findings showed that there could be factors such as time spent on an assignment or parent involvement which could affect student performance (Marzano, & Pickering, 2007). They also made known the viability of homework to student's performance and went a step further to make it clear that "inappropriate homework may produce little or no benefit" (Marzano, & Pickering, 2007).

While focusing on the homework aspect of the problem, I propose a system to properly tackle the appropriate nature of assignments given. This system would also help monitor the regularity of assignments and other supplementary exercises. By allowing parents, first, review any assignments that their wards answer, the worries of many current and future parents would be quelled. This system would be in the form of a cross platform mobile and web application to ensure that it would be easily accessible to the general public. Parents, for instance, would be able to closely monitor what assignments their children are doing as well as the quality of the questions set.

The platform would help to set at ease the concerns of parents more concerned about the teachers in charge of their wards. By allowing parents to review student's submissions, teacher attendance would be indirectly monitored. The application will also provide supplementary exercises even if teachers are absent. To sum it up, the intended mobile and web application has the potential to curb the concern of the populace as to where Ghana's educational is heading.

1.2 Motivation

In Ghana, the rate of completion of up to secondary education has improved but leaves much to be desired. Over the years, the completion rate has climbed steadily from 4.58% in the early 2000s to over 40% as early as last year (Education : Percentage of teachers by teaching level of education and recruitment status , 2016). This rate can only bring about more questions as to

why there are still many students not completing their education. Reports by the ministry of eduaction as well as articles previously stated have shown that there are some myriad reasons why this is so. These reasons range from the lack of quality textbook materials, inappropriate assessments, lack of financial resources to the uncertainty of the qualifications that teachers hold. By identifying some of the issues, this project will seek to develop a solution that could, in the long run, benefit the Ghanaian educational system greatly.

1.3 Problem Statement

The current educational system does not provide enough confidence to assure stakeholders of quality education. For instance, students still run the risk of not having adequate resources and relevant study materials to better themselves. Unfortunately, parents concern themselves with whether teachers entrusted with these students' wellbeing are giving appropriate assessments. One of the main problems affecting the education system deals heavily with the uncertainty of teacher training and general inefficiencies which is a growing concern for the public (Dei, 2004). Technologies such as the InfoView SIMS can be used to better the situation but it only helps to solve a smaller scope of the problem.

1.4 Benefit of System

An educational application for the Ghanaian environment would help improve the ability of students and quell the concerns of parents with respect to assessing the quality of assignments and teacher attendance. Appropriate assessment materials for students can be gauged by mainly parents and teachers. Additionally, the results of students can be tracked and this can give parents, teachers and students themselves a more immediate overview on their performance. As an added benefit, parents can also monitor the attendance of teachers. The system will be fair and easily accessible by all parties and would also create a platform for easy evaluation and assessment.

1.5 Project Objectives

The focus of this project is to build a standalone platform to aid teachers, parents and students assign, approve and submit assignments provided respectively and ultimately to help parents check attendance or participation of teachers. Project objectives are:

- Design and implement a system to facilitate assignment distribution.

- Implement a mobile and web application that could evaluate assignments and facilitate inter-user communication.

- Implement an application that could provide attendance information.

1.6 Background

Education has existed and is poised to continue being an integral part of our society. And with this existence, education facilities have used diverse ways to carry out the educational process. From using the traditional formal method to the use of written and projected works to aid in the formal education process. In education, institutions have often taken advantage of current technologies to further the education process. It is, therefore, no surprise that since the explosion of the internet, there have been endeavors to incorporate it into the classroom setting. This was also explored in a Ghanaian context where the use of computers and the internet as educational materials was gauged. The results of which showed that a sizeable number of students had favourable results while using the internet based educational resource but had little or no interaction with their teachers (Amenyedzi, Lartey, Dzomeku, 2011). An opportunity that can be further explored within Ghana.

There have also been many works that sought to explore why students within the educational system were not performing high enough. And these individuals research has brought about many recommendations that tend to support the use of technology to promote education and

improve performance. One such research recommended that by strengthening supervision and incentive packages for teachers, students' performance can be improved (Adane, 2013). Another such research recommended that teachers should use the most recent and most relevant teaching materials during their teaching to better improve student performance (Ige, Ogunleye, 2016). One other research found that there were many factors that affected student study patterns, factors that ranged from lack of parental involvement, lack of sufficient study materials and students' unwillingness to study (Nuobeikaa, Tetteh, 2015). The creation of a web and mobile homework platform would enable parents to be more involved since they would be needed to approve any assignments the students submitted.

Now there are some already existing applications that provide similar but not the same needs. Web platforms such as *littlebits.cc* and *Blackboardhelp. com* provide an interactive platform to help create programmable inventions and submit or mark assignments. The Littlebits website has a component for educators to purchase tool kits which can be used in class lessons and in-house assignments. These tool kits can be used to build great machinery and mechanisms that can be used from grade 3 to 8, corresponding to Ghanaian class 3 to JHS 3. Blackboard Help, for example, provides a platform not for everybody, mostly, students in college have all their information on one platform. Parents do not have access to this platform hence cannot monitor or evaluate what their children are doing but at the same time, the platform provides case educational support to teachers, students and administrators. The above projects helped inform the development of my project.

A project with a similar platform to provide assignments and assessments to students from teachers and parents in an interactive manner. Making it fun for students as well as allowing students, parents and teachers a platform to interact outside of the classroom.

1.7 Existing Solutions

In this section, some existing systems are discussed.

1.7.1 littlebits.cc

littlebits.cc is a web platform that allows children to invent in and outside the classroom. This platform uses magnetic easy to build and use blocks, called bits, to educate the young on how to build child friendly innovative and interactive devices and machinery. This platform uses a fun interactive interface to educate children on coding and engineering all from the comfort of their homes. Also, the bits can be used by teachers and school administrators in the classroom as learning tools or assessments. Figure 1.1 shows a section of the website where school teachers or administrators can purchase sets for student use. However, such a system is not generally applicable in Ghana because the educational system is not designed to incorporate minor engineering and computer programming lessons in classes 3 and upwards.
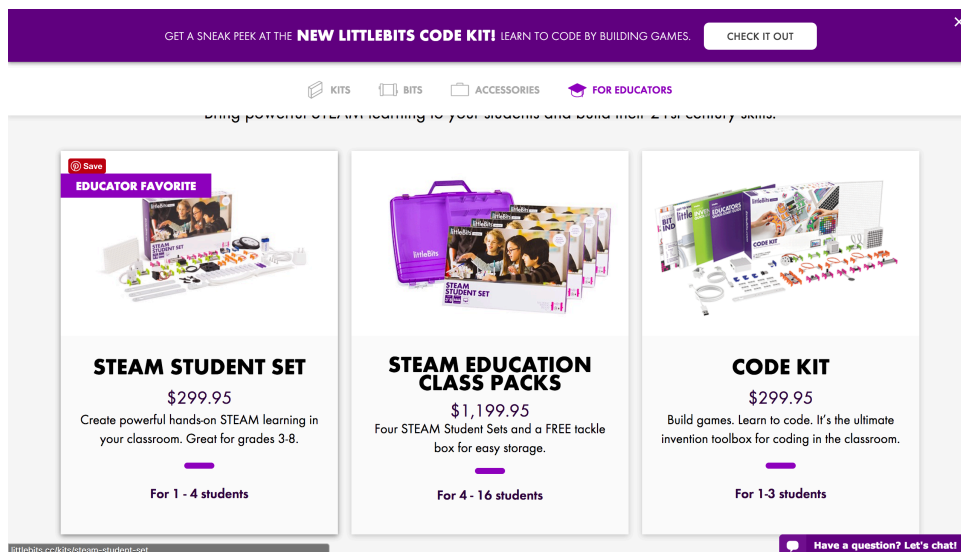

Figure 1.1 littlebits.cc website

1.7.2 Blackboard Help

This web platform is yet another that educates students on many subjects and devices through interactive interfaces. The unique thing about Blackboard help is that it utilizes a cross

platform approach to answering questions, viewing class updates, notifications and online chat services. This platform allows for a mobile application that helps students and teachers communicate and interact better.

The exception is that parents are not allowed access to this application. Figure 1.2 below shows the interface for teachers. This reveals that the platform is not for students who are not in college at least. Hence parental oversight is not needed or can be ignored. This website is adequate to allow for online assessment of assignments and the like but since parents are not allowed access it defeats the purpose of a solution in the Ghanaian context.

Figure 1.2 Blackboard Help website

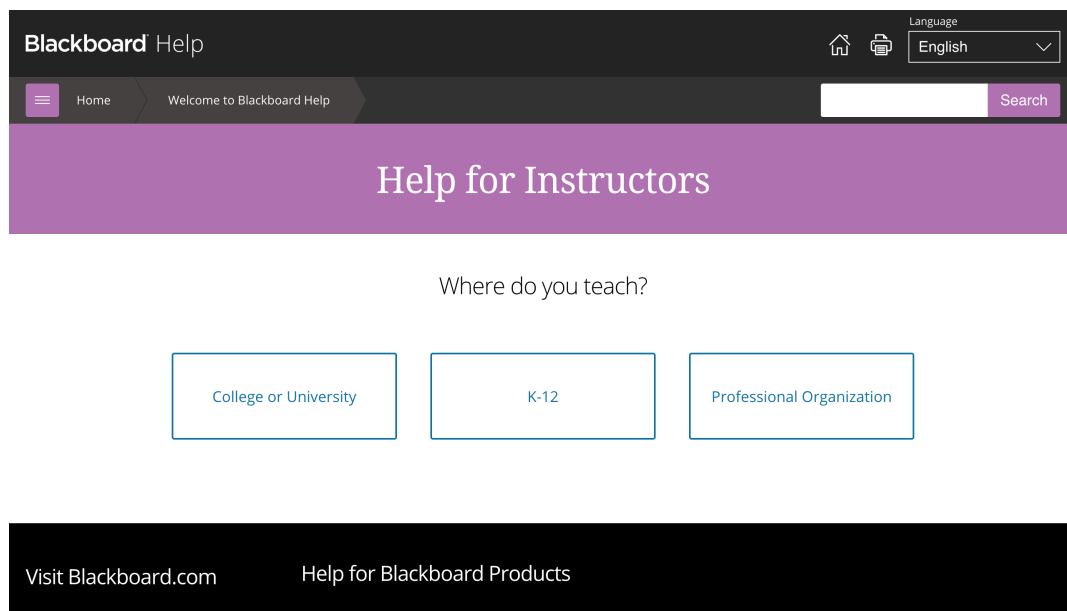### 1.7.3 InfoView SIMS

This mobile application is a student performance management system that allows parents to monitor their wards' performance as well as financial information. This application covers only a select number of primary schools within Ghana. The application allows parents to manage their children's classes, their teachers as well as allows for communication throughout the platform.

Figure 1.3 below shows the android application download page. Though the application has been deployed in Ghana, it is only available on a smart phone. This limits the possibilities it has to reach other users. Also, parent users must access the application solely on the phone platform and does not give them detailed information on student assignments.
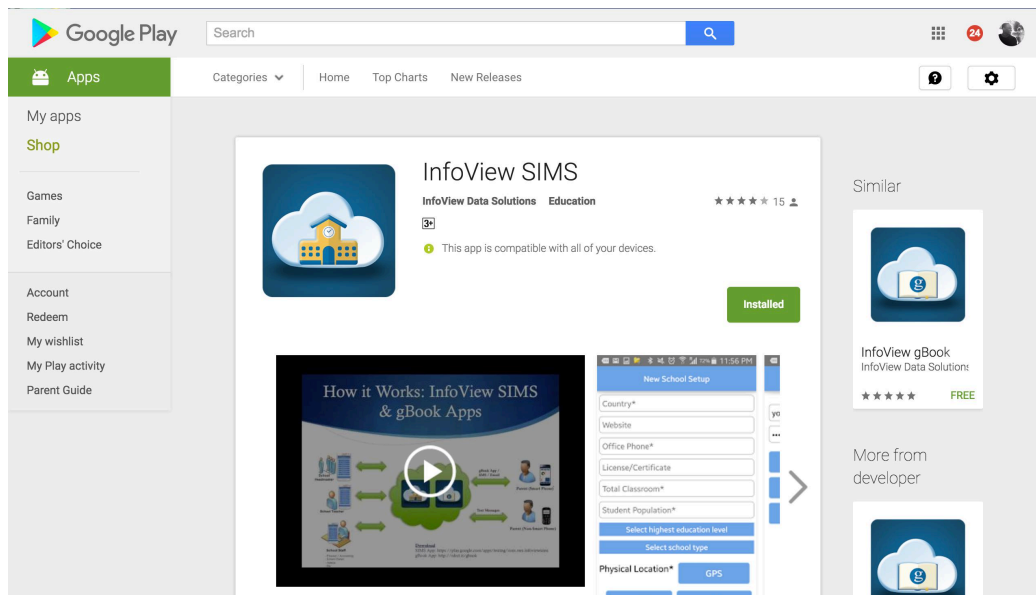

Figure 1.3 InfoView SIMS android application page

1.8 Proposed Solution

This project identifies the lack of a more effective educational assessment assignment distribution system. It utilizes already established algorithms and techniques to develop one suited to the Ghanaian education. It will include an SMS notification system to notify users that their assignments have been received or taken note of. And would focus mainly on the ability of parents to closely monitor teachers as well as their wards.

1.9 Summary of Background, Techniques and Technologies

Platforms and technologies have been expounded in this chapter to afford the reader a deeper understanding what exists and what can be used to implement such systems. In the next chapter, the requirements specifications of the proposed system are discussed.

Chapter 2 : Requirements Specification

The purpose of this chapter is to provide a detailed description of the functionalities of the EduApp System. This chapter describes the project's target users, hardware and software requirements.

2.1 Project Scope

The EduApp Application comprises of a mobile and web-based system. The system is designed to facilitate the distribution and grading of assignments which makes both the process of answering and submitting the assignments less tedious.

2.2 Overall Description 3.2.1 Product Perspective

The EduApp project is primarily intended to run on multiple mobile devices as well as on web platforms. The client-side of the application will handle a wide array of activities. These will range from allowing students to answer and submit assignments while parents and teachers will approve and evaluate assignments submitted.

2.2.2 Product Features

The product should have the following features available within the application. It should allow for *Assignment distribution*, *grouping of students by class*, *message communication within application*, *reminder capabilities*, *online receipt system*, *visualization*, *assignment submission* and *Rating features*. All users on the application should be able to visualize any submitted and marked set of homework questions.

2.2.3 User Class and Characteristics

Since the application will be a platform to help distribute assignments as well as help form relationships between different user types. The main user types are listed below:

1. Teachers

2. Students

3. Parents

4. Administrator

From the list of users above, parents, teachers and students should have access to general report data and should also be allowed to view specific data relating to their respective user accounts. The teachers, on the other hand will have data representing the students they have authority over. All the users will have access to the messaging platform but only the Teachers will have access to message all the users at once.

2.2.4 Operating Environment

The EduApp system needs HTML, CSS, JavaScript and PHP for the server-side web connectivity. There is also the option of using JavaScript for the server-side application.

2.2.5 Assumptions and Dependencies

- Email notification

The server will be responsible for sending notifications to the teachers and students. Once an assignment or test is submitted, the student will get an email notification. The same would occur when the deadline for an assignment has passed for the teacher. This feature will be developed with PHP.

- SMS notification

Students and teachers will be notified of work submitted or past due via text message. SMSGH teat messaging API has been identified to be used for implementing this portion of the application.

2.3 System Features

EduApp's system features comprise two main categories: core and additional features.

Core feature are the rudimentary part of the system and are essential to the system. These features will be prioritized over additional features until they are fully functional. Additional features are totally dependent on the time and will be added as time permits.

2.3.1 Requirements

2.3.1.1 Assignment Distribution

This feature allows teachers to send assignments to a group of students or student.

1. Teacher selects question

2. Teacher then assigns the questions to a group of students as homework.

3. Teacher sends the homework to students that they are authorized to.

4. Teacher can assign different types of assignments to students. This can be from multiple choice to written or timed to non-timed quizzes.

2.3.1.2 Groupings of Students

This feature allows teachers to group students according to their class.

1. After selecting a class, Teachers can choose which students will be in the class.

2. Allow the teachers group students into smaller groups for group projects.

3. Assures that students are assigned the proper teachers as well

An interactive GUI is needed. The use of HTML and JavaScript accomplishes this.

2.3.1.3 Assignment Submission

This feature allows students to answer and submit answered work to for grading either automatically or manually by the teacher.

2.3.1.4 Messaging Sub System

This feature sends submission and due date information to the respective users.

1. When work is submitted or past due, an SMS and email is composed and sent to the student and teacher.

2. These reminders are sent via PHP and SMSGH api.

3. Also, Teachers can send messages to their students within the application.

4. Teachers are reminded of any assignments nearing their past due dates.

A valid phone number and email address is needed.

2.3.2 Additional Features

2.3.2.1 Online Receipt System

1. Issues email and SMS receipt to students who have submitted their work as well as their grade.

2. Students can also view the results of their submission and grade within the application.

An email address is needed

2.3.2.2 Visualization

This feature allows users to view assignment history information.

1. Students can view their past assignment results.

2. Parents can also view the results of their wards when the navigate that section.

3. Teachers can also see the representation of the class results.

GUI implementation. By using the DataTables, HighChart and HighStock API this was possible.

2.3.2.3 Rating

This feature allows parents to review and approve assignments submitted by their wards.

1. Parents verify their children's work and approve of these assignments before the work is sent for marking.

Use of Javascript and HTML will accomplish this.

2.4 Other Non-Functional Requirements

2.4.1 Performance Requirements

Performance is not really a factor since there would not be much processing power needed. The only part of the application that might need more power would be with regards to the visual representations of data. These requirements are the application should be able to render multiple visualizations of data on a single page.

2.4.2 Security Requirements

The project assumes that the users will have access to handheld devices and therefore the major security concern will be with securing the users' email addresses, phone numbers and the test scores of the students. These requirements will be encryption of test scores and user passwords with a combination of MD5 and php session verification processes.

2.5 Summary of Requirements Specifications

In this chapter, requirements specifications have been discussed. This contained an overview of the user requirements and system requirements for implementing the EduApp system. Teachers are to be allowed the option of setting either timed or non-timed, multiple choice to writing type of questions. Also, all users are to be able to receive either SMS or email notifications whenever assignment updates are submitted. In the next chapter, the methodology and design specification are discussed.

Chapter 3 : Architecture and Design

This chapter describes the design specifications of the system as well as the architecture used to develop the EduApp.

3.1 Design Specification

This section gives a view of the EduApp system and its functionality.

3.1.1 Logical View

This section describes the functionality of the application to developers. For example, a student after answering and submitting an assignment, waits for verification from parents before the assignment is finally submitted as complete. The sequence of a such a user can be seen below. All other users would have to access a web server to enable them to access the database.
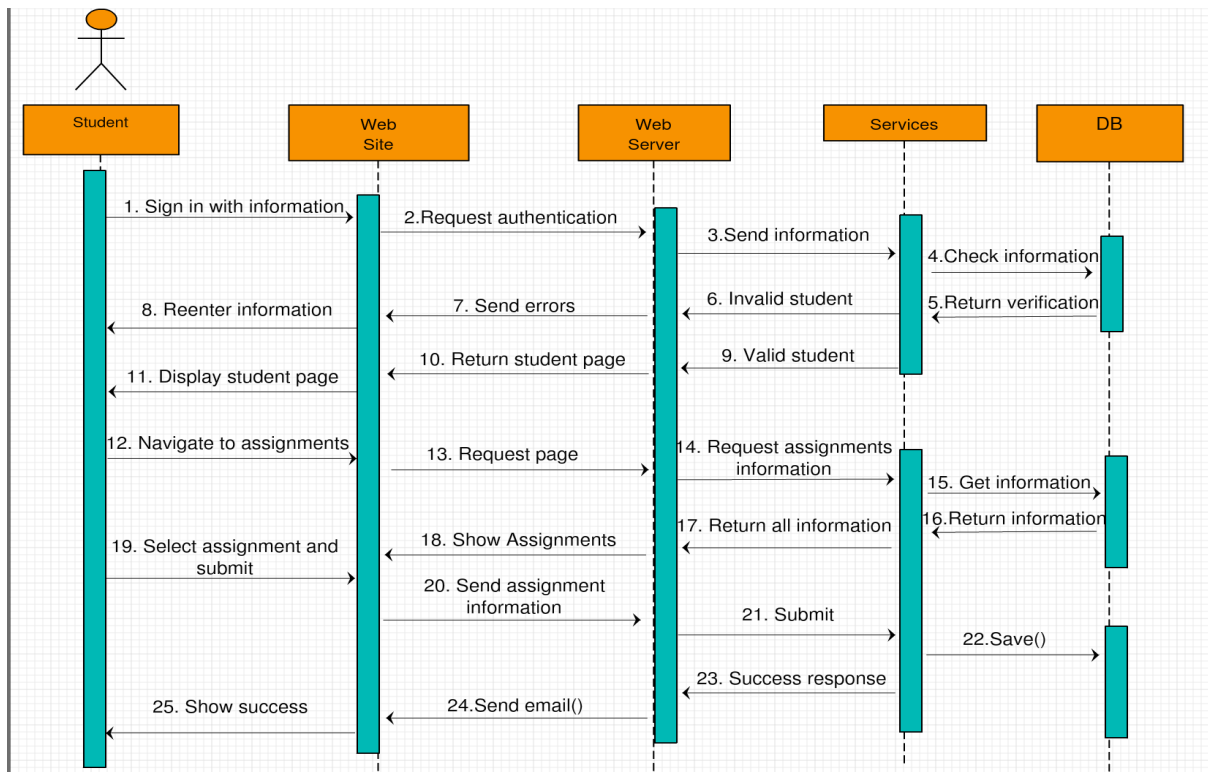

Figure 3.1 Sequence a student will go through from login in to submission of an assignment.

3.1.2 Process Activity Diagram

This view describes the synchronization aspects of the EduApp. The activity diagram in Figure 3.2 below helps to illustrate this.
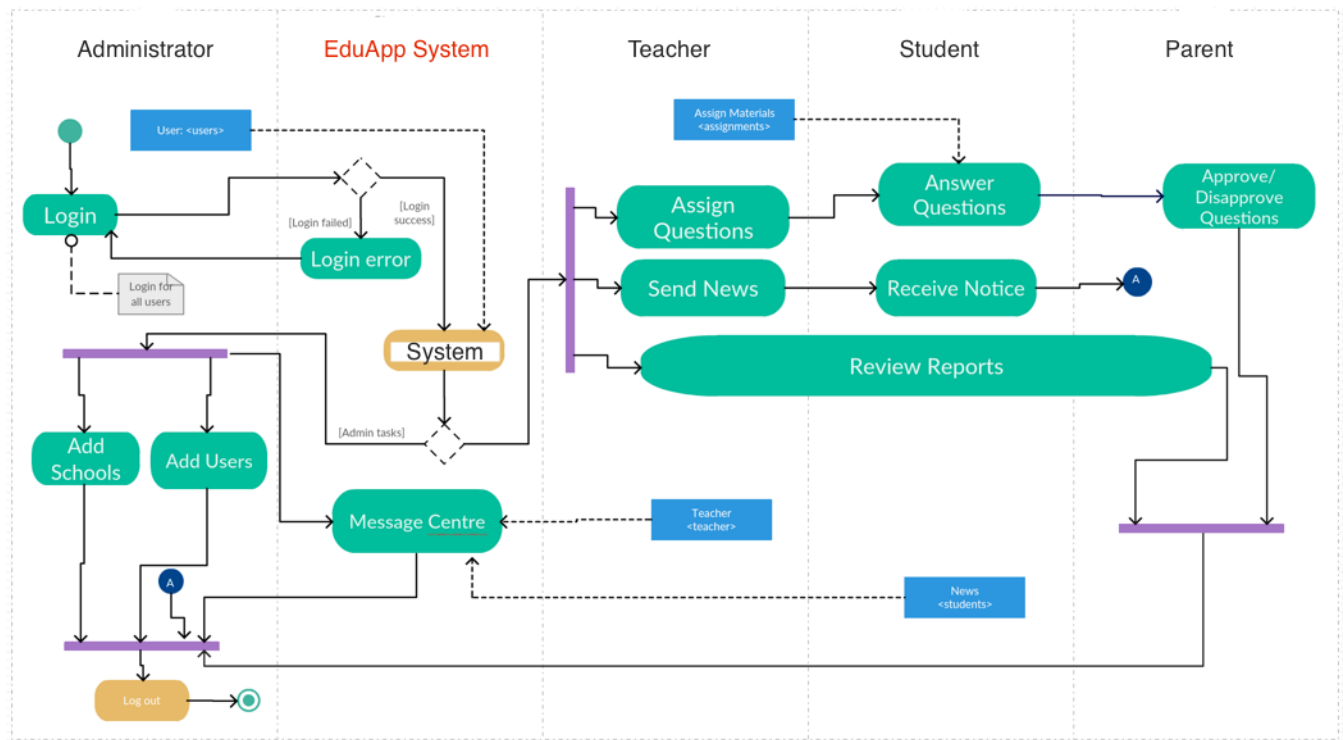

Figure 3.2 This shows the various activities of a student and parent while using the application.

3.1.3 Use Case View

This view describes how each user would be involved in the application. Their functionalities are also shown with the use of a use case diagram in Figure 3.3 below. The users are administrators, teachers, students and parents.
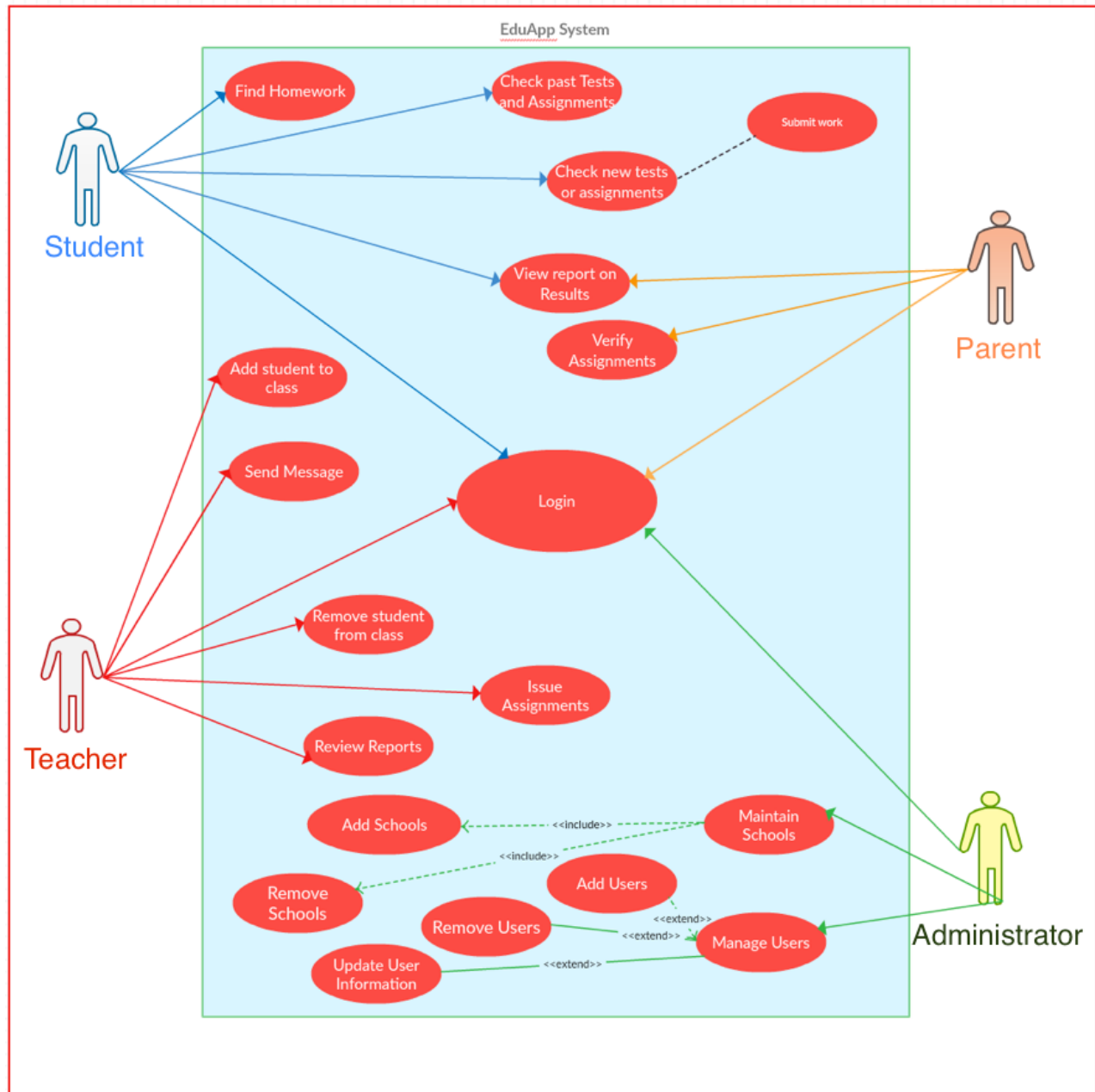
Figure 3.3 This shows the different use cases within the application.

3.1.4 Data Model ER Diagram

This section describes how the records and activities of the EduApp will be stored. The ER diagram below shows these relations. The table below also describes the 12 tables i.e. answers, assignments, class, completed_assignments, level, messages, questions, review_assignments, school, schoolclasses, topic_area and users tables.

Table Names	Uses
answers	This consists of answers to assignments that have been assigned to students
assignments	list of assignments and question information that teachers have created
class	has the information on the classes available and their corresponding integer value
completed_assignments	has the list of fully submitted assignments after parents have reviewed them
level	table has the information on the type of users available to use the application
messages	has the full list of messages sent on the application
questions	has the list of questions that teachers can select from
review_assignments	holds the information of the review status after parents have had a look at their wards answers
school	holds the schools information
schoolclasses	holds the list of students in each class as well as the teachers available for those classes
topic_area	holds the information of the various topics available on the application
users	table holds all the information of the various users of this application

Table 3.1 - Database tables and their uses

Figure 3.4 This ER diagram shows the data model of the database

3.2 Summary of Architecture and Design

In this Chapter, the architecture and design of the system was explained with the help of appropriate UML diagrams. In the next chapter, the implementation process will be described.

Chapter 4 : Implementation

4.1 Implementation

This section describes in detail the processes that were involved in developing the EduApp system. All appropriate snippets or code used to implement the system are shown in detail. Other technologies used for the development are also described.

4.2 Platform

To develop this system, a number of services can be used. This section describes these services.

4.2.1 PhoneGap

This application allows code written in solely HTML and JavaScript to be converted into either android or windows applications. Support for apple platform was available until only recently. But with this software, it is possible to code a web application and still convert the application to other platforms. The software is free as well.

4.2.2 HTML and JavaScript

PhoneGap is used and as such, the main programming language will be HTML and JavaScript. This will allow for easy cross platform implementation. The use of Foundation 6 for websites, which is a lightweight responsive design framework, will help with creating a styled responsive user interface.

4.2.3 PHP

PHP is a premiere language used to access database systems and JavaScript Ajax will be used to connect the frontend to the backend of the application.

4.2.4 Java

Java is a programming language that can be used for server side communication. And is at

times preferable to use with websites which have a high incidence of traffic. The preferred backend connecting language will be PH. Java is the backup instance for the project.

4.2.5 Ruby

This is a multi-purpose programming language and is more commonly used for its open source framework Ruby on rails. This framework allows the creation of dynamic websites quickly. As stated before, Foundation 6 will be used to create the application interface and Ruby is a backup option for development.

4.3 SMS Services

4.3.1 SMS GH

SMSGH is a gateway that makes it possible to send and receive text messages from a network operator in Ghana. It can also be integrated easily into other systems. SMSGH needs an internet connection and an account to operate.

4.3.2 FrontlineSMS

FrontlineSMS is an application that is used to enable instantaneous two-way communication to any mobile device. This application is free and open source and does not require the Internet. However, the airtime of the connected mobile will be used if sending messages.

4.2 Technologies

The user interface is built with the foundation 6 framework developed by ZURB , a product design company ("Foundation for Sites", 2017). This framework is flexible and responsive which makes the goal of this application being useful on both laptop screens and their smaller counterparts even easier to accomplish. I also chose the accompanying CSS to maintain a sense of consistency in design and flow. This coupled with the usage of HTML and Javascript made for a more interactive web site.

`   This application uses JavaScript, HighChart and HighStock APIs to generate the responsive graphs. It uses MySQL database to store the relevant data as well as uses PHP as the server side language. Alternatively, I could have used MSSQL or Oracle as the database and Java or Python for the backend. To host this application, I used xampp software to run my environment. This was mainly used for building and testing of the application in a local environment.

        Below are steps that some of the users, namely the administrator and student can take follow to accomplish an activity on the application. In Figure 4.1, the user would log in on these pages and if the user is an administrator, he/she will be redirected to the administrator page. This is the first page they are redirected to after logging in. From here they can browse both users, school and class information.

Figure 4.1 Login Page for both Screen Sizes

        Figure 4.2 shows the administrator add page. On this page, the administrator may add other administrators, teachers, parents or students. These newly added users are given a default password and would have to change it upon login. There is the option of signing up as new user at the logon page. but this is limited to users signing up as teachers, students and parents.
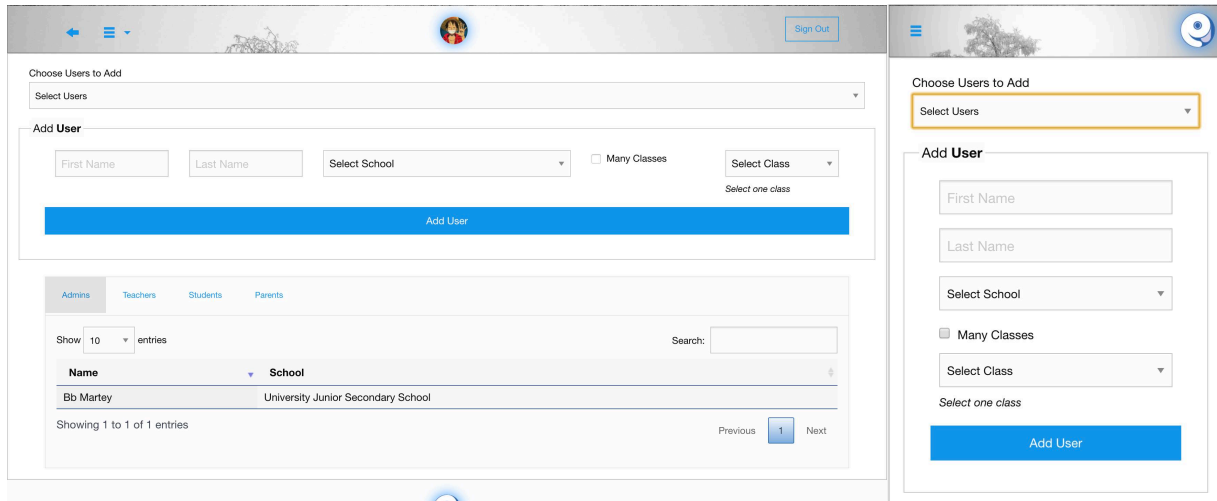
Figure 4.2 Administrator User Page for Both Screens

Figure 4.3 shows the administrator class/school add on page. Here, the administrator can add the option of classes and schools to the application.
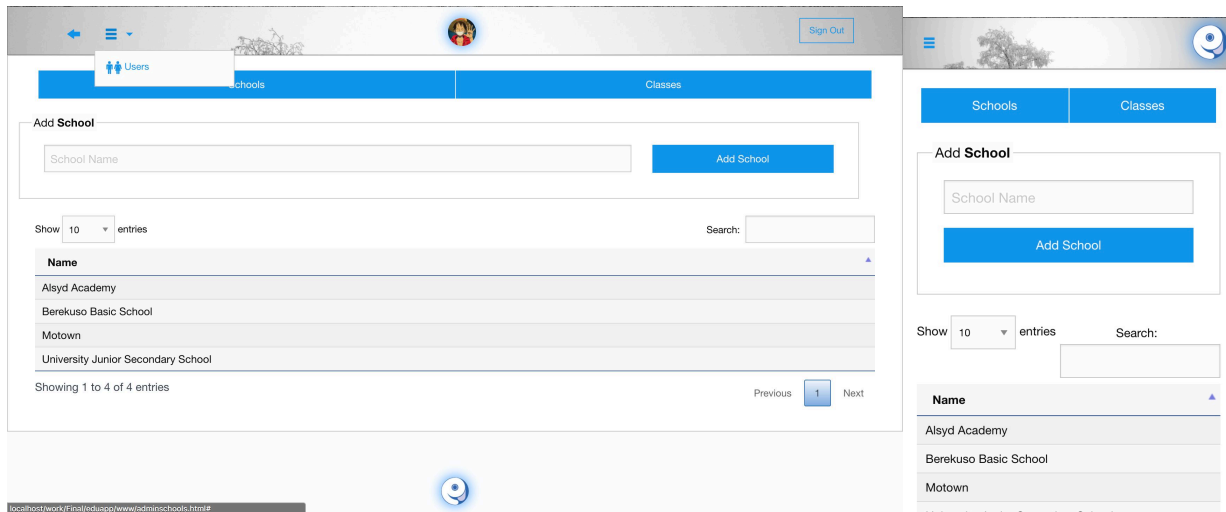

Figure 4.3 Administrator School and Class Page for both Screen sizes

The Student welcome page on both mobile and laptop devices can be seen in Figure 4.4. This is the first page they are redirected to after logging in. From here they can browse both Their
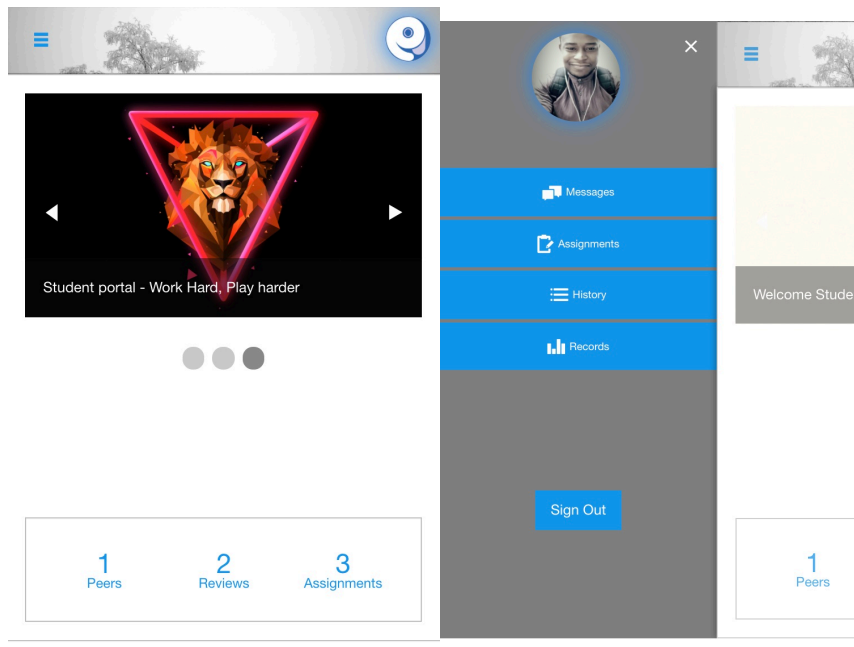
respective information.

Figure 4.4 Student Welcome Page for Smaller Screens

The student on the page in Figure 4.5, may answer any assignment they deem fit to. The actual answering of questions in the assignment is done on a separate page shown in Figure 4.6. On this page, the student answers the assignment and then submits.
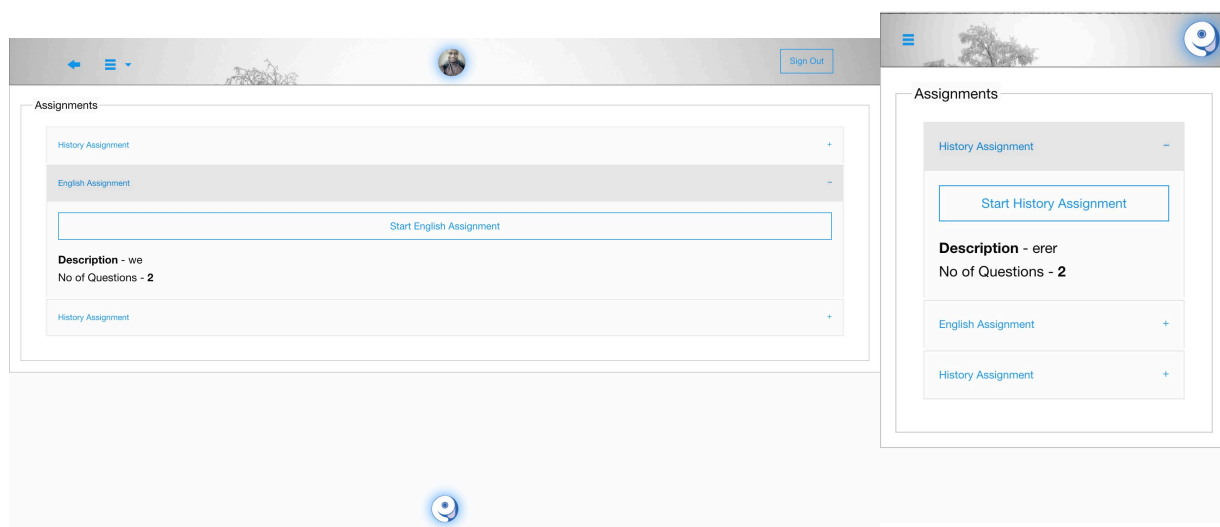

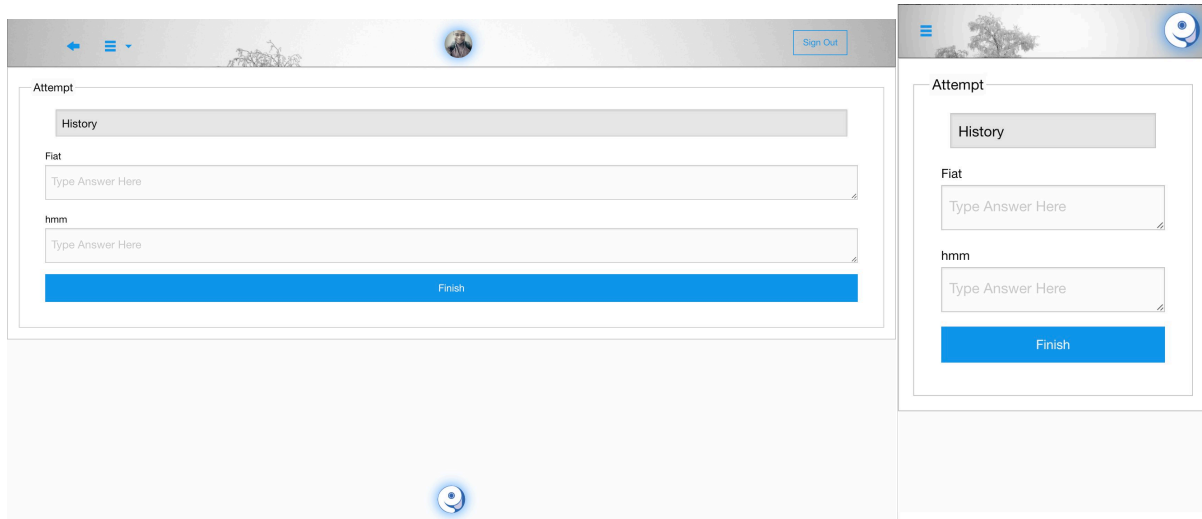Figure 4.5 Student Assignment Page For Both Screen Sizes

Figure 4.6 Student Answer Page For Both Screen Sizes

Figure 4.7 shows a page where the student can view their past results and can even go further to see the results in details. This is done on a separate page shown in Figure 4.8. On this page, the student can view the actual answers of their submitted assignments.
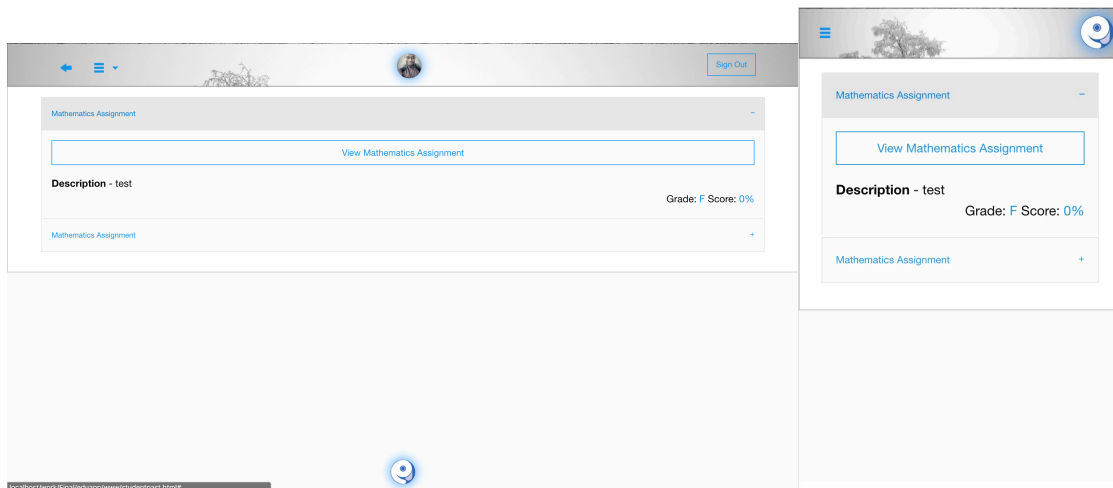

Figure 4.7 Student History Page for Both screen Sizes
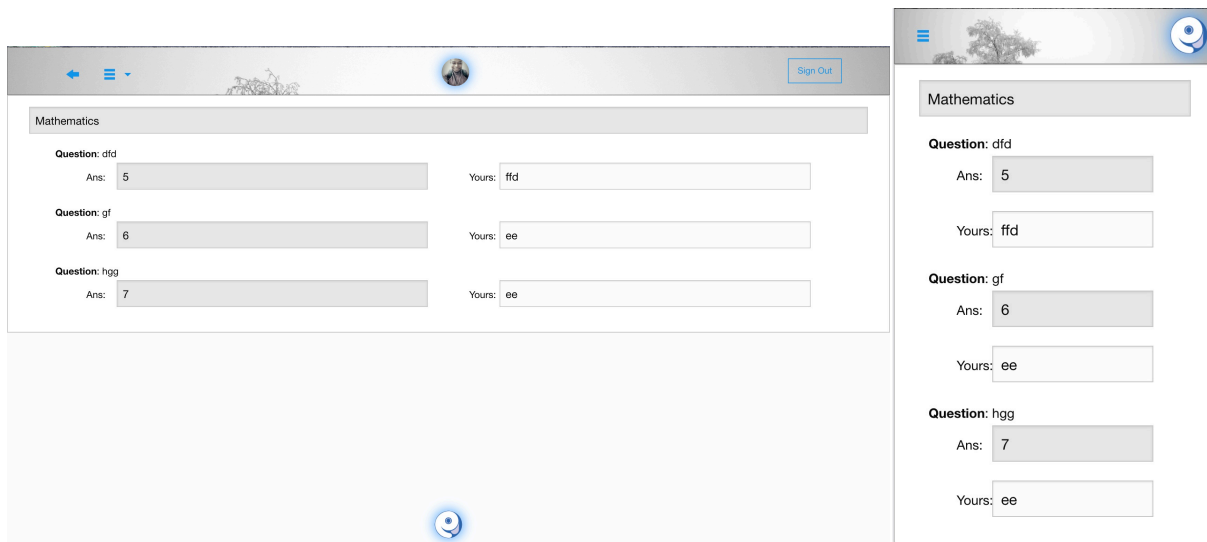
Figure 4.8 Student History View Page

On this page, the student can view messages sent to them from their teachers.
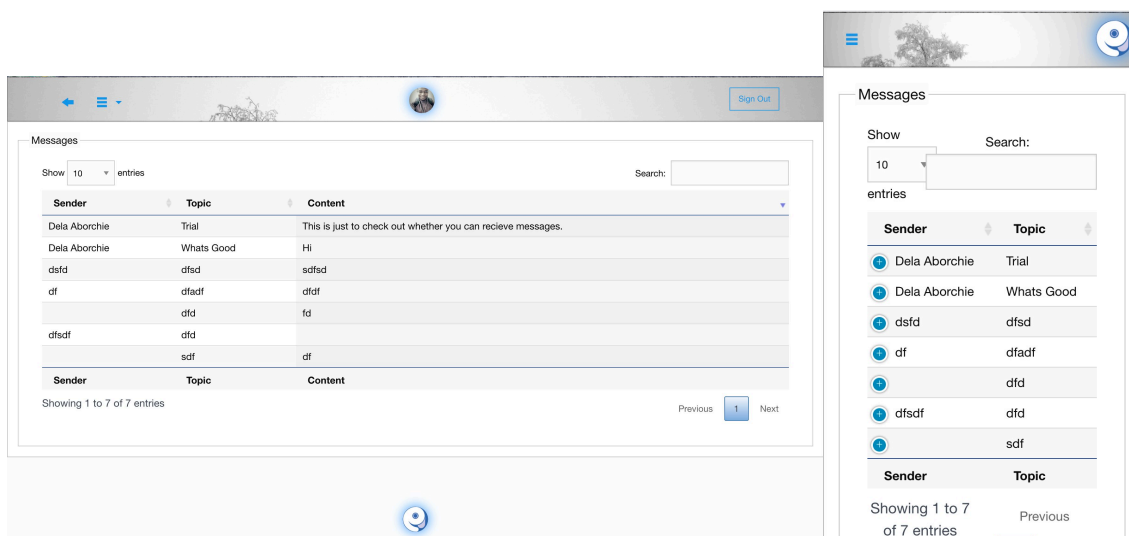

Figure 4.9 Student Messages Page

On this page, the student can view their summarized results and track their performance throughout the semester.
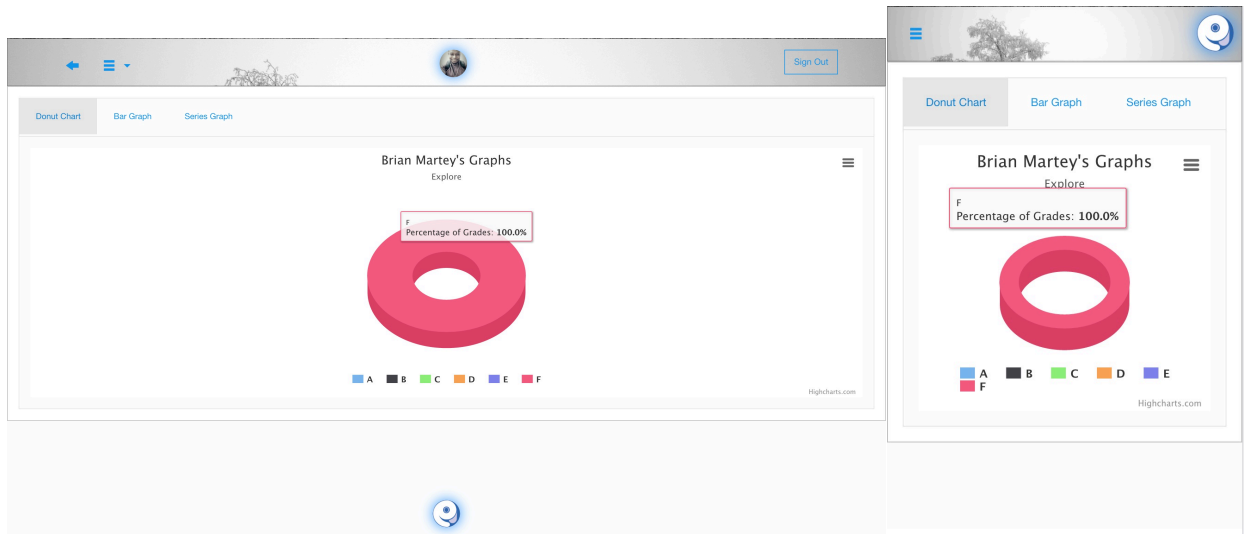
Figure 4.10 Student Report Page

After students have sent their assignments, parents are notified and then can approve or disapprove the assignment. This is shown in Figure 4.11 below.

Figure 4.11 Parent Assignment Approval page

The parent can also view information on their children, their results and grades over time. This is represented in the figures below.

Figure 4.12 Parent viewing their overall children assignment submission information.

Figure 4.13 Parent viewing a specific child's report

After the parent approval, the assignment can be sent to the teacher for marking or automatically

marked, depending on the type of assignment given. The figure below shows the teacher

marking a submitted and approved assignment.

Figure 4.14 Teacher grading an Assignment

The teacher can also view the student performance per class as well as seen in the figure below.

Figure 4.15 Teacher viewing class statistics - part 1

Figure 4.16 Teacher viewing class statistics - part 2

Chapter 5 : Testing And Results

5.1 Introduction

Testing involves verifying whether the developed system meets the different requirements (functional and non-functional) that 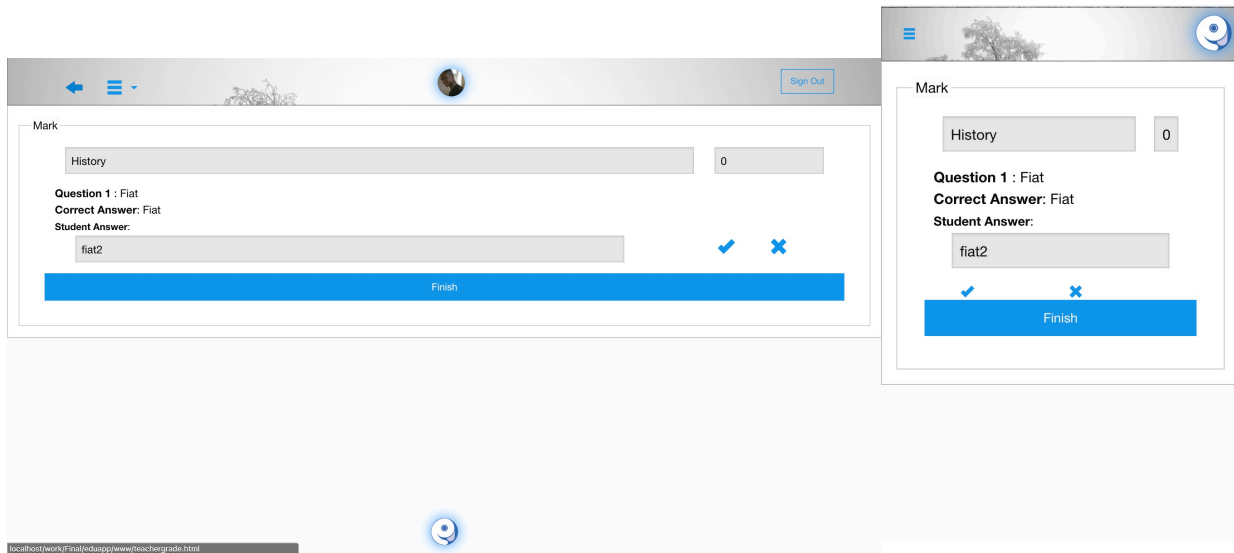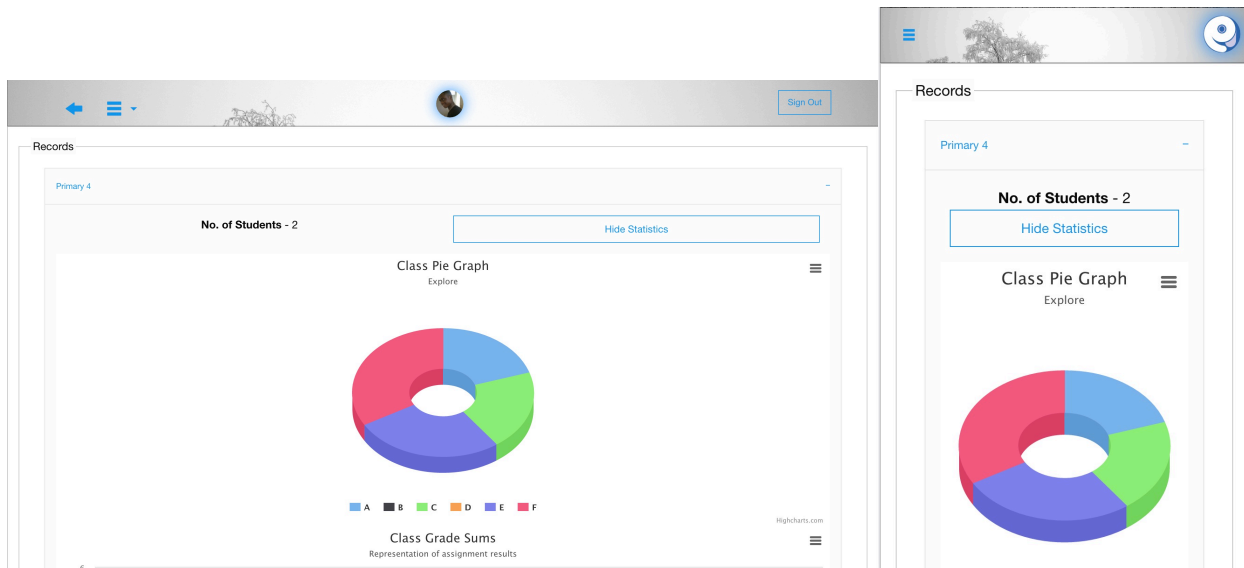were specified in the beginning of the project. This is done to guarantee that the system can perform the tasks it was developed for.

So far, I have performed some minor development and user testing.

The chapter helps explain the types of testing conducted and their results.

5.2 Development Testing

Development testing involves all the testing activities that are carried out by the development team while creating the system to weed out bugs (Sommerville, 2011).

This involves three levels of tests.

- Unit testing.

- Component testing.

- System testing.

5.2.1 Unit testing

Unit testing is the process of testing the methods and object classes that have been used to develop the software. I tested all classes within the application to show their functionality. The classes tested were the answers, class, grades, messages, questions, school, topic and users classes. I used PHPUnit testing for the testing of some of the methods whitin each of the classes mentioned above. The figures below show the steps taken as well as the results of testing the getgrades($stid, $letter) method in the grades class. The getgrades($stid, $letter) method fetches the number of a particular letter grade, represented by $letter, of a student by their user id, $stid. Figure 5.1 below shows the getgrades method in the grades class.

```php
<?php
/** written by Brian Martey
*/
header('Access-Control-Allow-Origin: *');
header('Access-Control-Allow-Headers: X-Requested-With, Content-Type');
include_once("adb.php");
/**
*grades  class
*/
class grades extends adb{
    function grades(){
    }
    /**
    *get class
    *returns a boolean true if successful, else, false
    */

    function getgrades($stid, $letter){
        $strQuery="select COUNT(lettergrade) from completed_assignments where stid ='$stid' and lettergrade ='$letter'";
        $result = $this->query($strQuery);
        if ($result){
            return $result;
        }else{
            return $result;
        }
    }
}
```

Figure 5.1 getgrades() method in grades class

The test class below was used for the testing.

```php
*/
class testclass extends PHPUnit_Framework_Testcase
{

    function testgetClassInfo()
    {
        $class = new classes();
        $this -> AssertTrue($class -> getclasses());
    }

    function testgetGrades()
    {
        $id = 1;
        $letter = B;
        $grades = new grades();
        $this -> AssertTrue($grades -> getgrades($id, $letter));
    }

    function testgetClassGrades()
    {
        $grade = 4;
        $letter = F;
        $grades = new grades();
        $this -> AssertTrue($grades -> getclassgrades($grade, $letter));
    }

    function testgetMessages()
    {
        $messages = new messages();
        $this -> AssertTrue($messages -> getmessages());
    }

    function testgetQuestions()
    {
```

Figure 5.2 testclass which is used for testing

I then ran the testclass in the terminal using "phpunit --bootstrap grades.php testclass".

Figure 5.3 below shows the results from running the test.

```
[Brians-MacBook:www brianmartey$ phpunit --bootstrap grades.php testclass
PHPUnit 5.7.19 by Sebastian Bergmann and contributors.

.......                                                          7 / 7 (100%)

Time: 157 ms, Memory: 12.00MB

OK (7 tests, 7 assertions)
Brians-MacBook:www brianmartey$ ▊
```

Figure 5.3 testclass executed in the terminal

The testclass above tested a few of the functions in each of the classes mentioned above to make sure that the implementation process would be as accurate as possible.

5.2.2 Component testing

A component is created by integrating multiple units. This form of testing focuses on testing the component interfaces (Sommerville, 2011). All the units in the eight classes have been implemented independently. Meaning that each class can function without the other classes. These classes go further to extend a base class which handles connection to the database, error handling and execution of queries.

5.2.3 System testing

System testing involves integrating various components together to create the system (Sommerville, 2011). And as in the previous paragraph, each component has been developed independently and combined for functionality of the system.

For example, to create a user, the administrator has to, first, select the type of user to be added. Then assure the input fields are not empty. In this case, I tested the functionality of the administrator and the system and validated data put into the fields submission. Similar to the Figures below. This validation process applies to both the mobile and web view of the application.

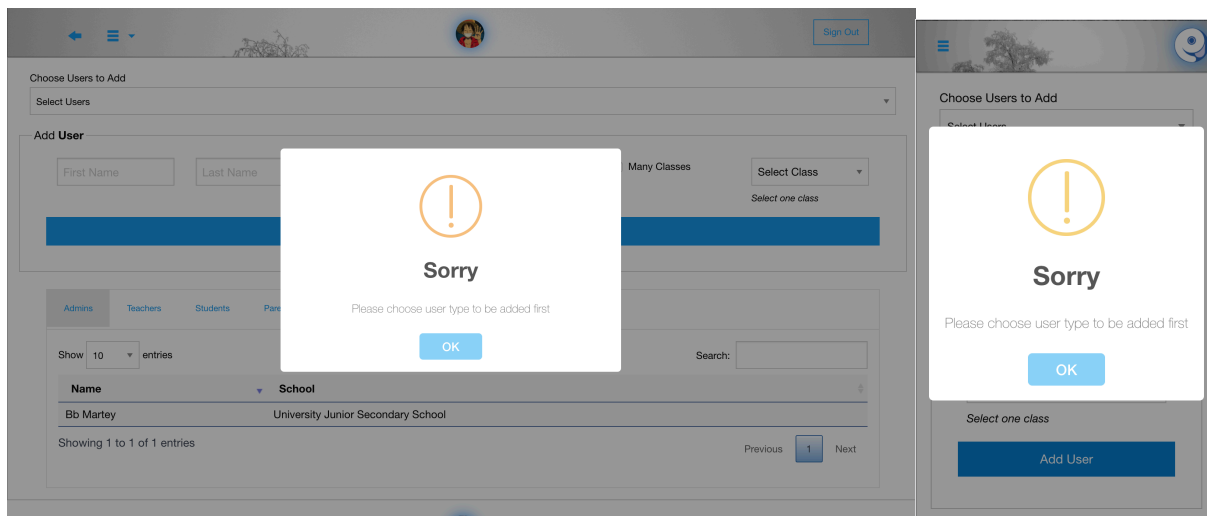Figure 5.4 User type Validation for the administrator Desktop and mobile Views

Another example is the handling of assignments. This ranges from teachers setting assignments to students answering them to parents approving the assignments for marking. This testing was done to guarantee that the email notification was working. The figures below show this in action.

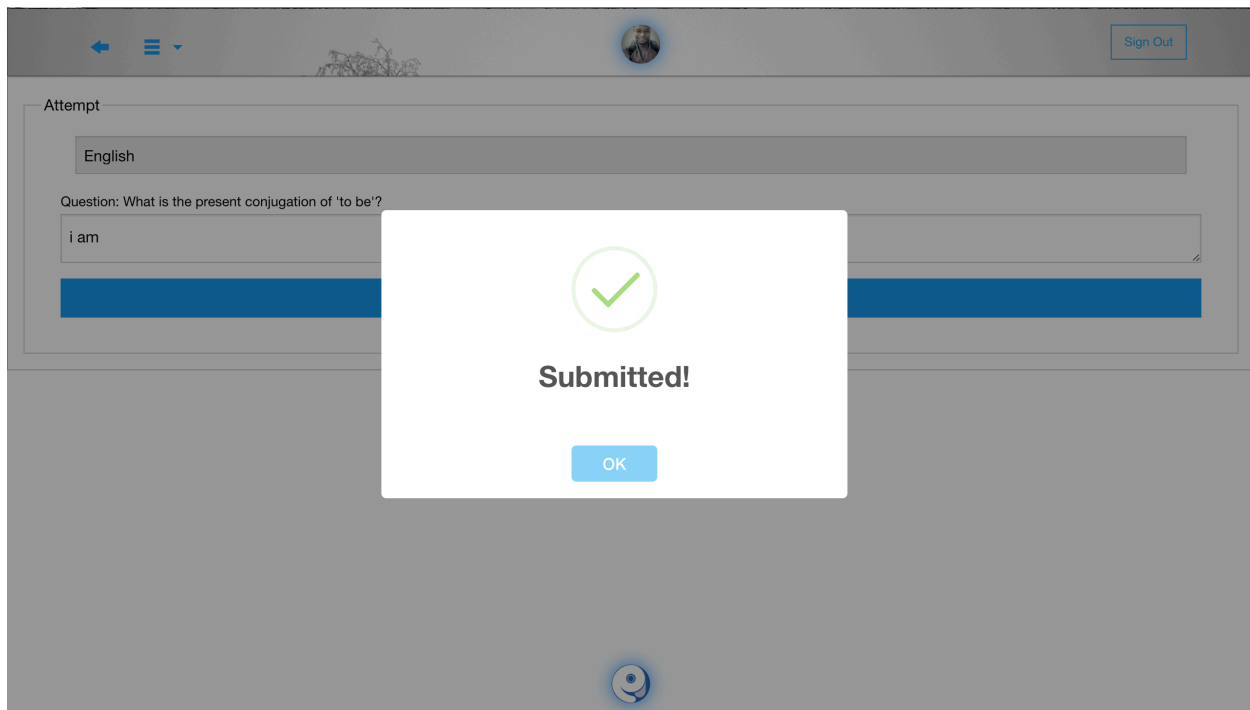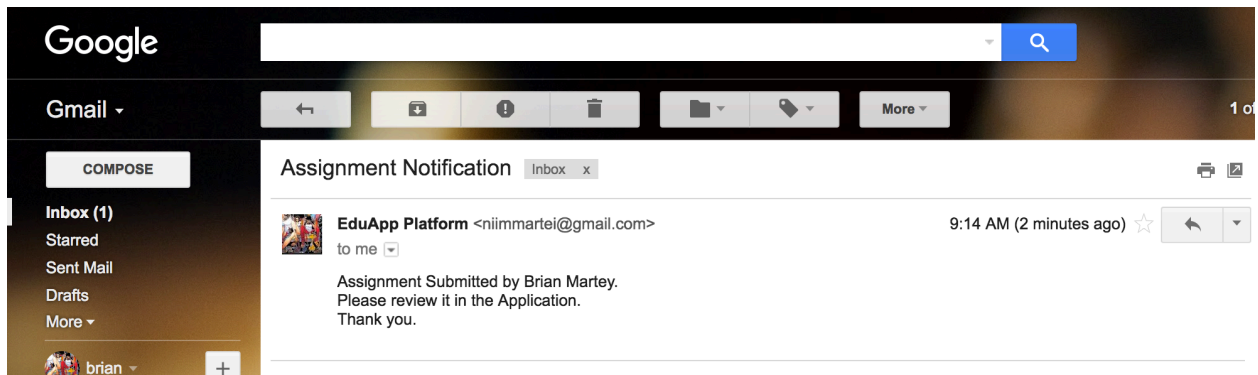
Figure 5.5 Student submitting an assignment

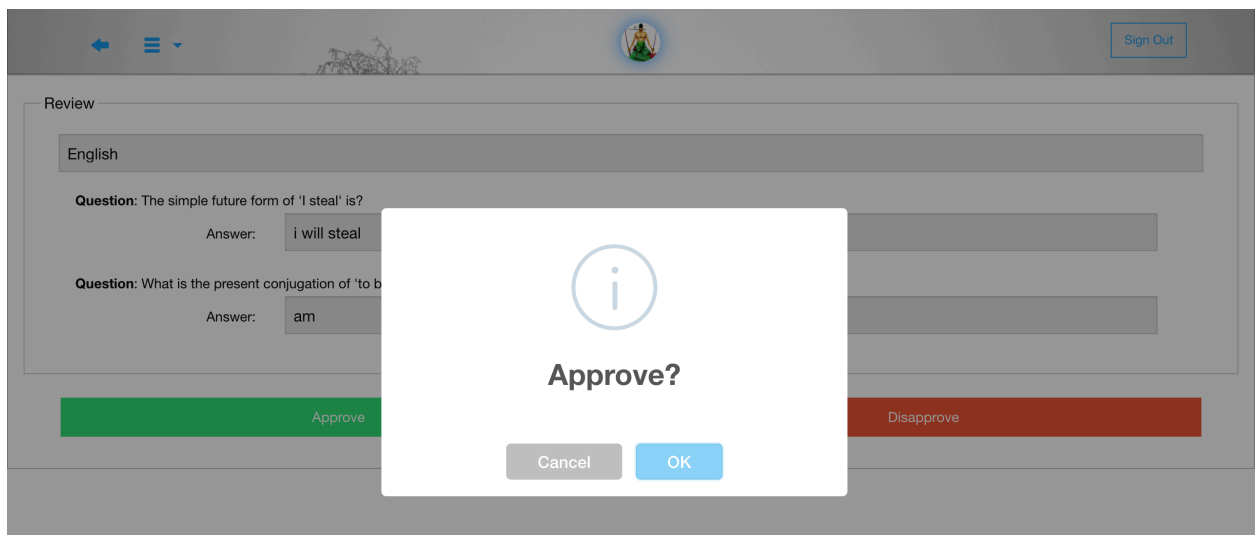Figure 5.6 Email notification of student submission to parent

Figure 5.7 Parent approving child's work

The above Figure 5.7 shows the approval process for parents. After the assignment is approved the children are notified and they are assured their work is ready for assessment as shown in Figure 5.8.
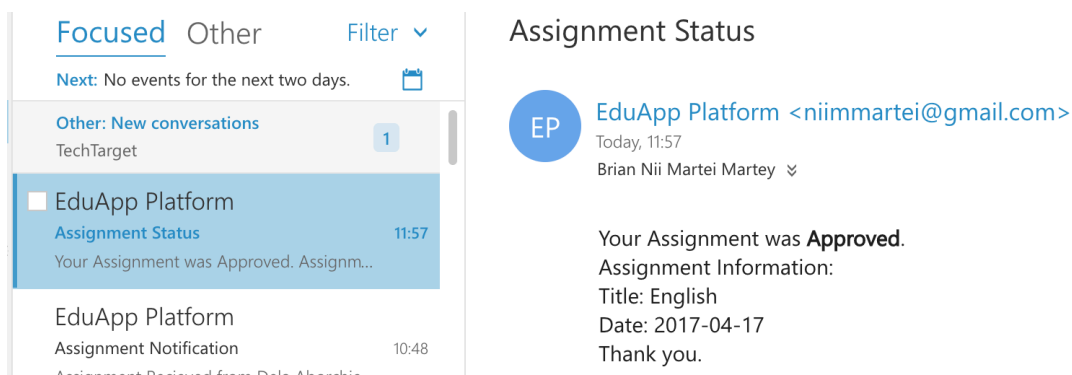

Figure 5.8 email notification for student

The above image shows the student's notification after their parent has approved of their work. The above tests applied to assignments that were not time sensitive.

The above tests were done to guarantee the implementation of the notification, assignment creation, submission and approval features of the application. That was aside other minor features such as login.

5.3 User testing

User testing involves giving the system to the users for acceptance testing. In this testing, the users can identify flaws in the system that the development testing did not cater for. I conducted this testing by requesting five random students at Ashesi University to test the software. Though they were not the typical user of the application, their feedback was valuable. My focus was to evaluate the usability of the EduApp while the users interacted with it. I briefed the users on what the software is meant to do and gave them tasks to perform, such as log in, create an assignment, search for users and answer assignments. I monitored the users during the exercise and noted the tasks that were easy and difficult to perform. I then took their feedback after the exercise.

5.3.1 Testing results

Below are the results of testing process.

- The users, in general, were confused as to how to log out with the original design. The exit icon, ✖ , used was not really clear on its function. The initial stage of my testing the exit or logout icon's position made it hard for users to absolutely know it use.

- When the users logged in with the new account details they did could not change their password and they felt that this was a security issue.

- The users found that they could not edit their settings from their respective pages and this

functionality was needed.

- Administrators were also able to search for users they looked for. Administrators could add and remove different users and schools without a problem.

- Users who logged on as teachers could create assignments and publish them to the intended classes. The process was not cumbersome but some practice as to how to maneuver the creation process was needed. These same users were also able to grade existing work that their students had submitted. There were some issues with the implementation of this feature in all the instances tested and I was advised to improve upon the grading feature in particular.

- Users who tested as students could answer and submit the assignments they answered. They were also notified on the approval or disapproval status that their parent users gave their submitted work.

- Users who logged in as parents could approve and disapprove work that their children had submitted without any problem. The only issue was that apart from this, they could make any comments are edit the work on behalf of their wards.

- All users could view and interpret the graphical information that was presented to their various views.

- The summary of details on the welcome pages also helped to notify users of any new additions. For example, the students page had a statistic of new assignments available.

Chapter 6 : Conclusion and Recommendations

6.1 Introduction

This chapter gives an overview of the milestones achieved over the course of development of the EduApp. Recommendation and future development is also stated below.

6.2 Conclusion

Education is a major aspect of our environment and due to the gradual reduction in performance over the years, parents have been continuously concerned about what it is that is causing this decline. There have been some causes identified such as the lack of resources within the school environment and the quality of teacher training being a cause. There have been solutions that have been thought of to help improve the educational performance of students. One such solution is the InfoViewSims application. This solution has been incorporated within the Ghanaian context to help facilitate the management of student services in schools, however, it lacks one important feature. That feature is the ability of parents to monitor the quality of assignments given to their wards, approve of those assignments and check the attendance of both their wards and teachers.

This project identified technologies that can be used to create a more appropriate application that eases the worries of parents especially with regards to the quality of assignments and teacher attendance. This project used a graphing, SMS and email APIs.

The integrated software used the Highcharts and Highstock APIs and the SMSGH APIs. The system, called EduApp, can allow students answer and submit work fully, parents approve or disapprove of their submitted work and allow teachers to create and send out an assignment to the respective class that they teach. The EduApp can also allow all users, except the administrator to view graphically generated data on students answered and submitted assignments.

6.3 Limitations

The EduApp has a number of limitations which include:

- The limited set of question types and features that teachers can create. Teachers are limited to only text answer format. There exists the creation of new assignments and automatic marking with which the teachers can work with. It would help if they could upload images, have a timed setting allocated to assignments and be able to have multiple choice answers.

- The Application relies heavily on the internet in the sense that there is no local database existent. If there was to be no internet, users would not be able to log into the mobile application. This makes the application limited in its use.

6.4 Recommendations and Future Work

The EduApp can be improved by including the following features.

- Implementing the user settings aspect of the application fully will allow users edit their own information without the need of the administrator to.

- Purely mobile or android development for the application will provide a more suitable fit for the application on mobile devices. This is because there are some functionalities that would be better represented on mobile devices that are built via native development rather than other means.

- Adding a more complex messaging feature will make for an even more interesting application and experience for the users. By having it such that users can send messages through the platform, they will interact more and will provide a more involving experience.

- Adding an assignment database with more suitable questions will allow for the application

to be more diverse and have a wider array of options and topic information to choose from when answering or setting questions.

- Expanding on the assignment creation feature would allow teacher give more varied questions to their students.

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