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ENHANCING STUDENTS' ACADEMIC RECORDS MANAGEMENT SYSTEMS USING SHORT MESSAGE SERVICE GATEWAY

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ABSTRACT

It is a normal practice for academic institutions to store student academic information such as examination results in a dedicated computer server system and allow students to access them when necessary. Most of these systems are web based information management systems, which they are accessible via internet only. The aim of this paper, it is to present how to enhance the existing systems by adding SMS functionality to them. The development of an enhanced system, which I named it as Students' Academic Records Management System with Short Message Services, will be used as an example. This is a system, which provides students' with an alternative way of accessing their academic records using short message service (SMS) apart from the internet. For developing the system, PHP has been used as a programming language, Database for storing students' examination results and SMS request history, SMS gateway for routing requests and reply messages to and from the system and waterfall model has used as a software development methodology. This system provides the capability for students to access their examination results using SMS, when it is impossible to access via the internet. Additionally, Students' Academic Records Management System with Short Message Services is a working system, which was tested in a real environment, and it seems to work fine.

KEY WORDS: *Short Message Service (SMS), SMS Gateway, Backup path, Internet, Mobile Network, Modem.*

INTRODUCTION

The students' academic records management system with short message service it is not the first academic records management system. There are existing web based information management systems, which require enough skills, an internet connection and devices which are capable of browsing the internet such as computers and smart phones, in order to access examination results (Student Academic Register Information System, 2015), Consequently, students face some challenges in accessing these systems if they lack one of the mentioned requirements. Generally, it claimed that, despite the existence of these systems, they failed to address the following: (i) to provide students with an alternative way of accessing their examination results when there is no internet connection, (ii) to enable students' who does not have smart phones, computers and enough skills of browsing the internet, to access their examination results (Figure 1), shows student at home which is point 'B' cannot access examination results stored on the college server at point 'A' via internet when there is a link down between A-B.

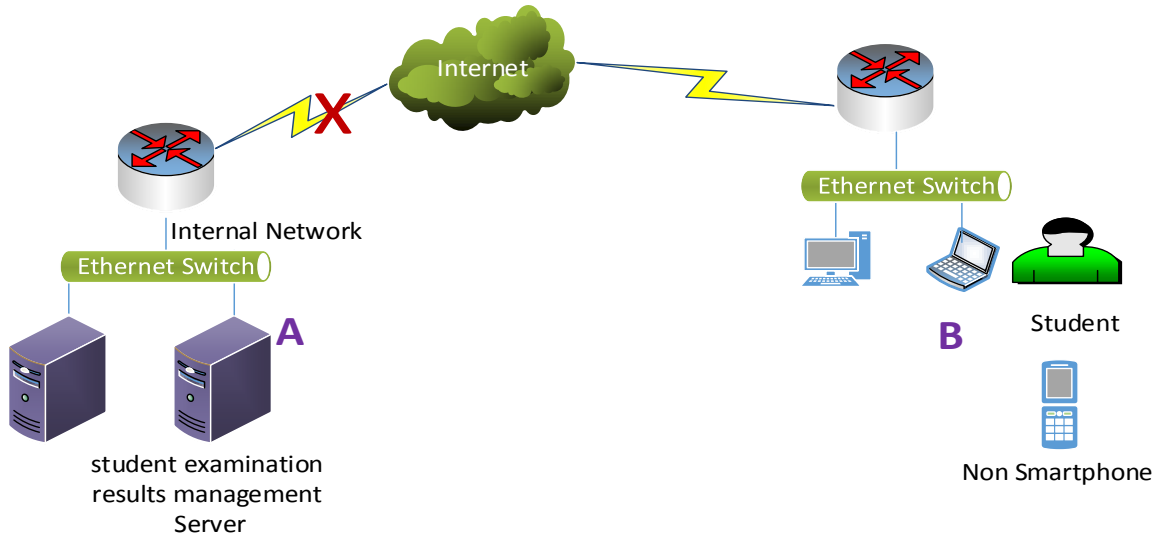

Figure 1. Student at point B cannot access exam results at A when there is internet problem

LITERATURE REVIEW

There have been different efforts made to develop student examination results information management systems such student academic record system, SARES which is used in Ruaha Catholic University, SARIS (Student Academic Register Information System, 2015), which is used in the College of Business Education, Academic Record Information System (ARIS) used in the University of Dar es salaam, and flexcms used at the Nelson Mandela Institution of Science and Technology. All these systems are Web based and they are accessible only via internet. The students' academic records management system with short message service it is also somehow similar to Multi-functional network monitoring system using SMS (Kijazi & Kisangiri, 2014) except that, the system was implemented to access network monitoring server using SMS rather than accessing student's examination results server. In the same way, it is similar to SMS based wireless home appliance control system (Raghavendran, 2010) which was implemented for accessing and controlling home appliance via SMS in order to automate and protect against intrusion. Furthermore, Students' Academic Records Management System with Short Message Services for the purpose of solving academic issues it is similar to SMS-based final exam retrieval system on mobile phones (Rohiza et al, 2014), which was used by students to retrieve examination time table by using SMS to track the current changes.

HOW THE SYSTEM WORKS?

Students' academic records management system with short message service, it is also a web based system but with extra functionality of SMS. This means, students can access examination results from the system using both internet and SMS. The way of accessing the system via SMS provides an alternative way apart from the internet, (Figure 2).The system serves the following advantages

compared to the existing systems, (i) it provides a student with the capability of accessing his/her examination results without internet connection, (ii) It can be accessed using a non-Smartphone so long as it supports the SMS functionality, these kind of mobile phones are easy to use, cheaper and affordable by most of the students compared to smart phones.

In order for students to access examination results via SMS they are simply required to send a request message to the system. The message contains login details. When the message received on the system , the system uses the message content to find respectively student examination results and send back to the student. Additionally, login details should be registered in the system before.

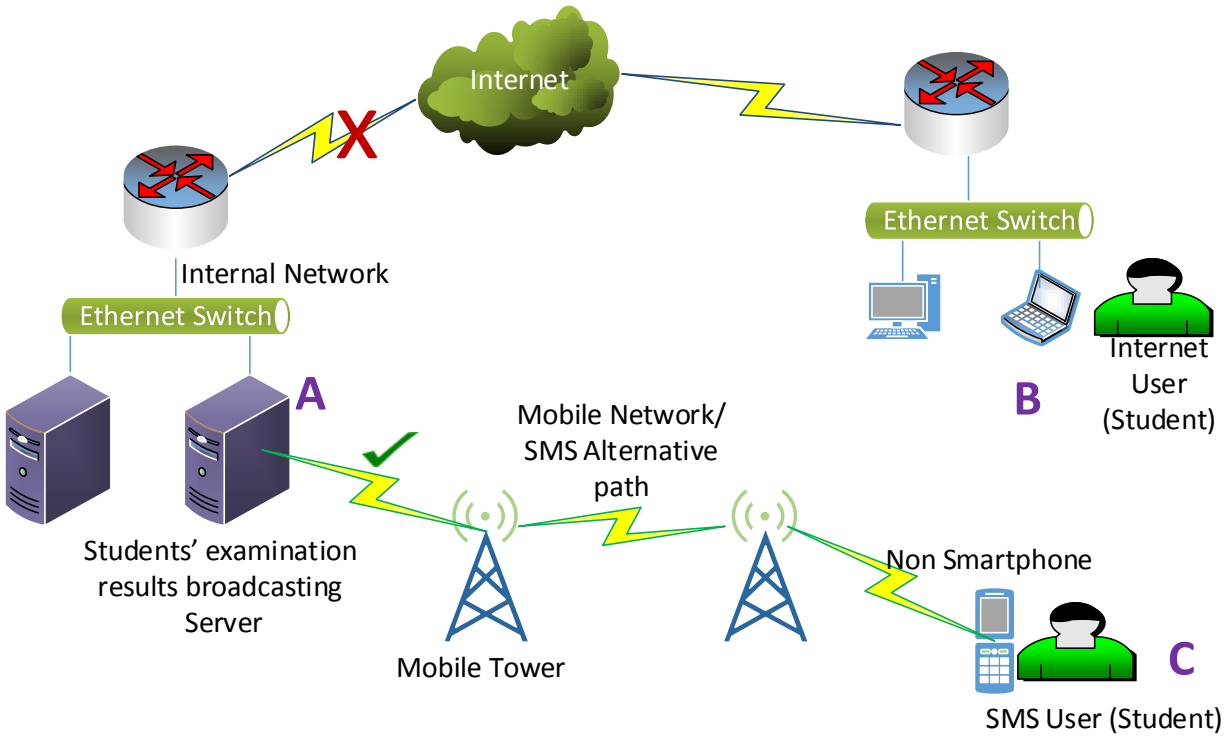

Figure 2. Mobile network provides an alternative path when internet connection failed

METHODOLOGY

Before Students' Academic Records Management System with Short Message Services was developed, a preliminary study has been conducted to see if the existing academic records information systems they have SMS functionality for accessing examination results. The systems from three academic institutions, they were taken as samples, Student academic register information system (SARIS) used in the college of business education, Academic Record Information System (ARIS) used at University of Dar es Salaam, and flexcms used at the Nelson Mandela Institution of Science and Technology. None of them seems to have SMS functionality.

Academic records management system with short message service gateway is application software like other software. Consequently, the waterfall methodology of software development has been used for developing this system. The waterfall model involves the following steps, requirement gathering, system design, implementation, integration and testing, deployment of system and maintenance (Waterfall model for software development, 2015).

System Requirements Gathering

In developing the system the following software and hardware have been used, Database, SMS gateway software, Modem with SIM card, HTML codes, mobile phone, PC installed with windows OS, Data cable and PHP programming language.

Figure 3. Hardware and Software Components

Database

The Database is used for storing examination results of the student as well as keeping records of messages request and replies. The Database is connected with both the interface developed with HTML and the SMS gateway using PHP and Database connector.

SIM card

It provides the telephone number. SIM cards are tied to a particular mobile service provider and can only be used with a service plan from that provider. You can buy a SIM card at any shop of any mobile service provider.

Modem

It is a specialized type of modem that accepts the SIM card. You can connect it to the PC with a data cable for sending/receiving SMS messages.

Data cable

The data cable connects Modem to the PC

PC installed any version of windows OS

This act as a server, which we are installing all software's and attach a modem.

SYSTEM DESIGN

System architecture

A students' academic records management system with short message service is composed of two parts which are Internet and SMS access part.

Internet Access Part

From the internet access part the system operates like other existing web based systems. The internet access part comprises of web interface, PHP codes, Apache web server and Database installed and contained in a high speed computer which is acting as students' exam results broadcasting server, (Figure 2). Lastly, the server is connected to the internet and can be accessed by students using computers and Smart phones with the help of web browsers, (Figure 4).

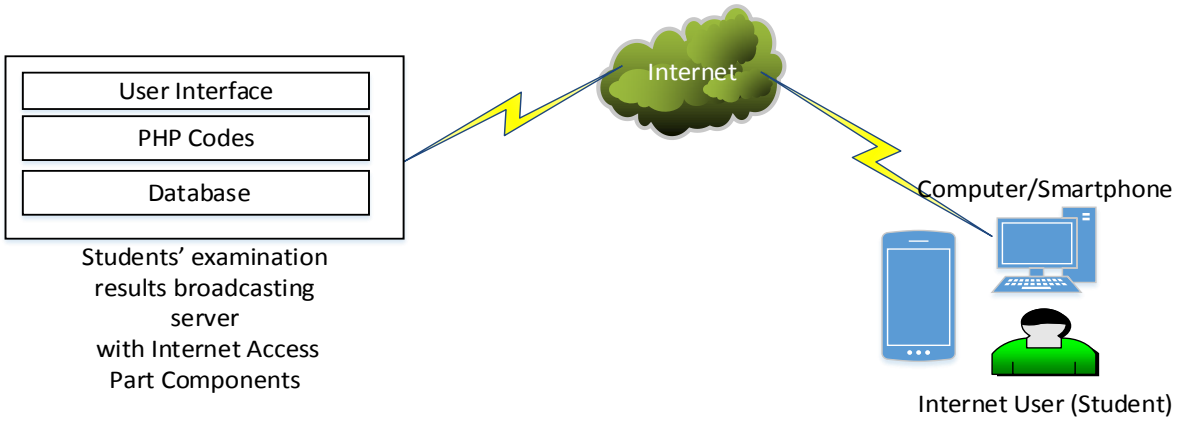

Figure 4. Internet Access Part

SMS Access Part

This is a second part of students' academic records management system with short message service. It has the following components; Database, PHP Codes, SMS gateway and Modem (Figure 5). The number of modems, those can be attached depending on the number of USB ports on the server and the capacity of the SMS gateway software. The SMS access part is operating via Mobile network; this is when a student requesting his/her examination results by sending a unique registration number to a given mobile number

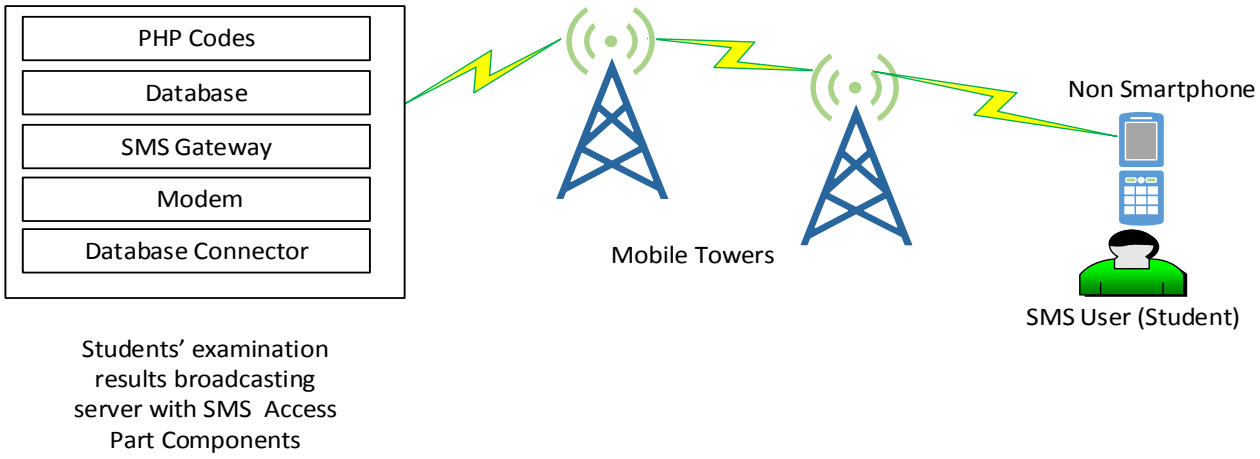

Figure 5. SMS Access Part

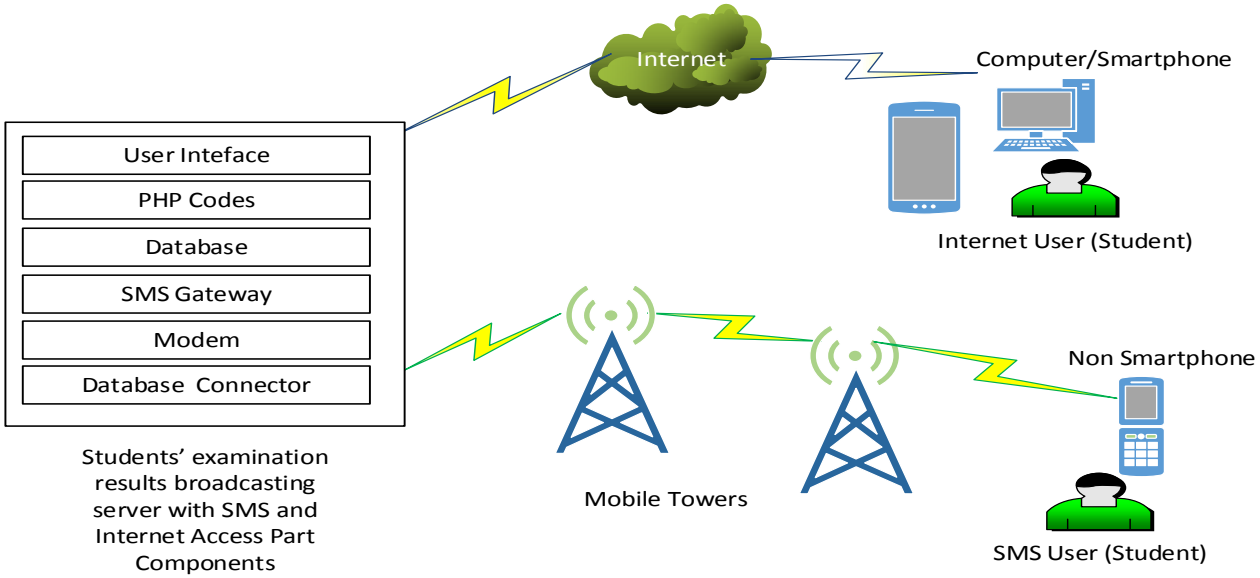

Figure 6. A Combination of Internet and SMS Access Part

SYSTEM IMPLEMENTATION

Before connecting Database connector with SMS gateway, first we are required to connect the Database connector with the Database (Database Connector, 2014). In order to connect Database connector with database the following steps should be followed.

1) Install the Database connector on the server computer
2) Go to control panel, in the administrative tools select a data source
3) In the data source, select the connector you want to use, (Figure 7).
4) The database connector configuration window will open, (Figure 8)

5) Fill all required fields include, Data source name which indicates the name of the database to access, Description, here we enter some text to identify the connection, Server indicates the name of the Database server host to access by default it is local host, User indicates the name of the database user by default it is rooted, Password field, enter the corresponding password for the connection and Database indicate the name of the database you want to connect to it.

6) Click Finish. You will be successfully connected to Database and Database connector.

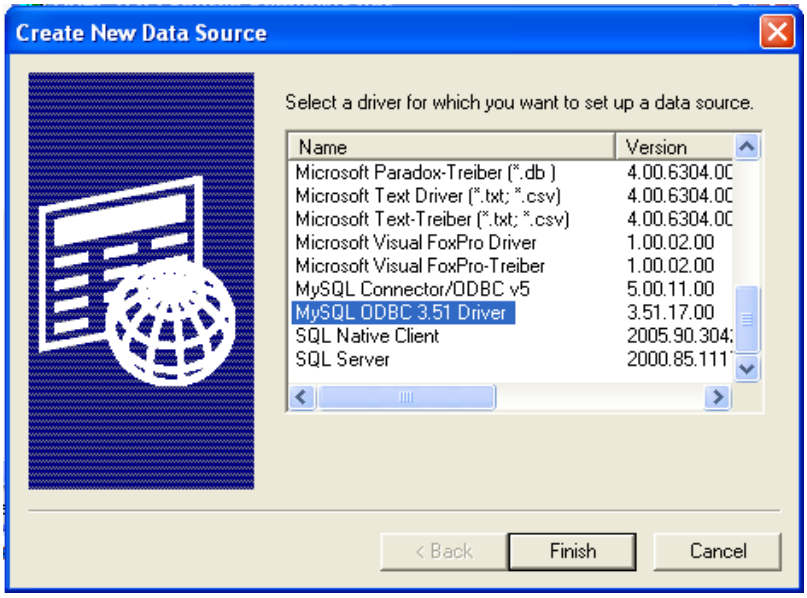

Figure 7. Database Connector

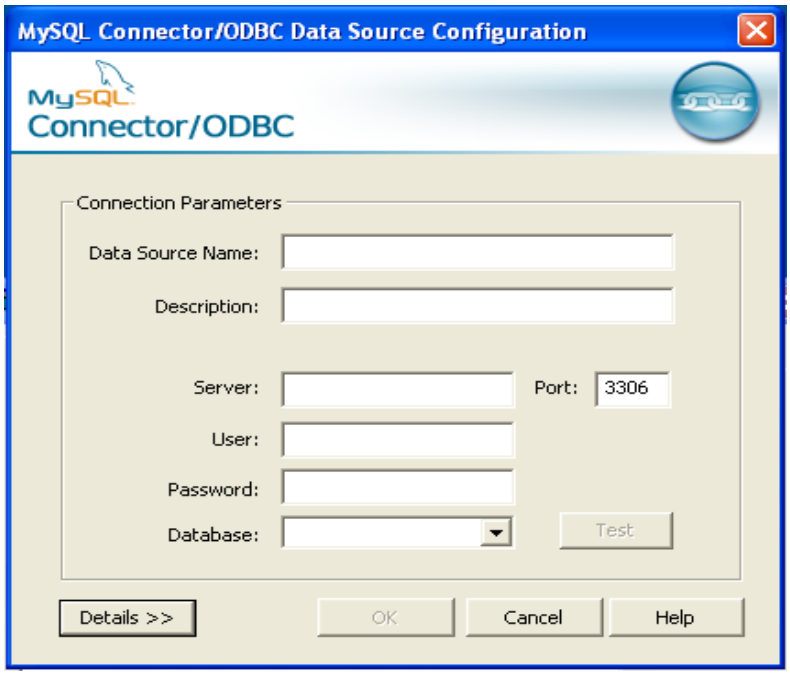

Figure 8. Database Connector Data Source Configuration

To establish a connection between a database and SMS gateway we are required to configure the database connection string on SMS gateway (SMS Gateway, 2014). The connection can be configured with a database connection string, (Figure 9).

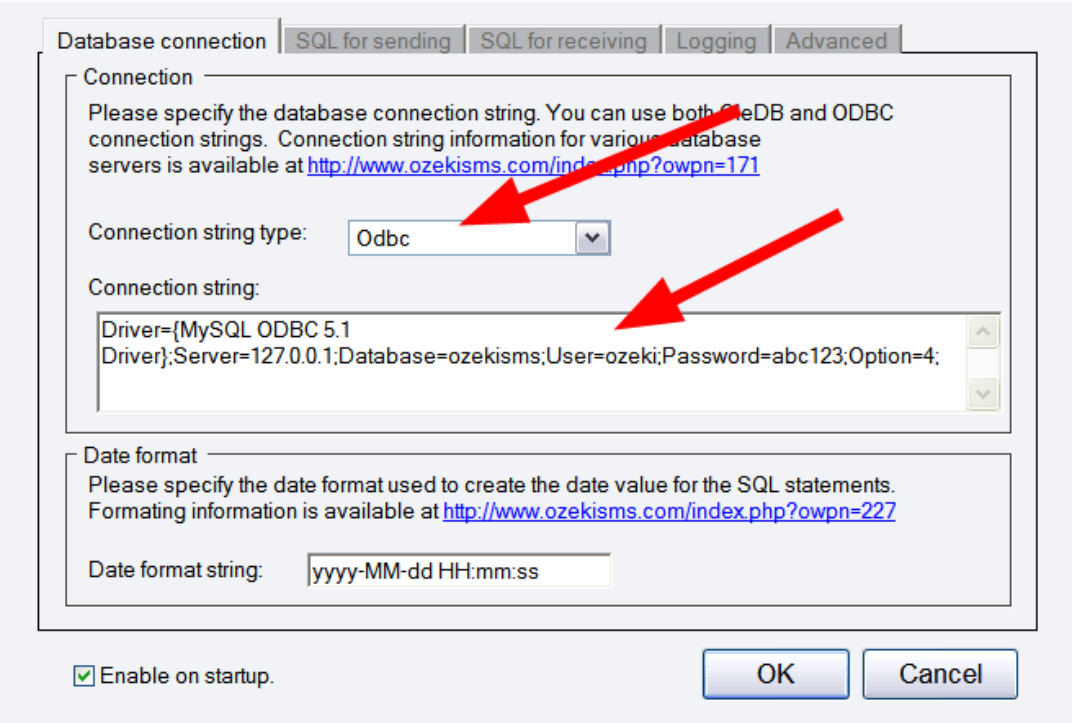

Figure 9. Connecting SMS gateway with Database Connector

SMS Gateway Software

It is software downloaded and installed on the server computer, purposely for routing messages between students' academic records management system with short message service and student mobile phone using the mobile network. The SMS gateway software connects to Database using Database connector, and to the modem with the help of the settings available in the software. The SMS gateway software fetches request message received on the modem and store them in the Database.

On the other hand, it fetches reply messages from the Database, forward them to the modem and then back to the students. SMS gateway is used to send and receive SMS messages using a Database server with the help of SQL queries, database servers allow the sharing of database tables between two applications. To be able to send SMS messages from a Database application you need to create a database table called "messageout". You can put an outgoing message into this database table using an SQL INSERT command.SMS Gateway will periodically check (poll) the "messagout" table with an SQL SELECT command, and if it finds a new entry, it will send the SMS to the student. You can receive SMS messages in a similar way. You need to setup a database table called "messagein". If SMS message is received from a mobile phone, it is inserted by the SMS gateway into the

"messagein" database table, (Figure 10). You can use an SQL SELECT to read this message (SMS Gateway, 2014).

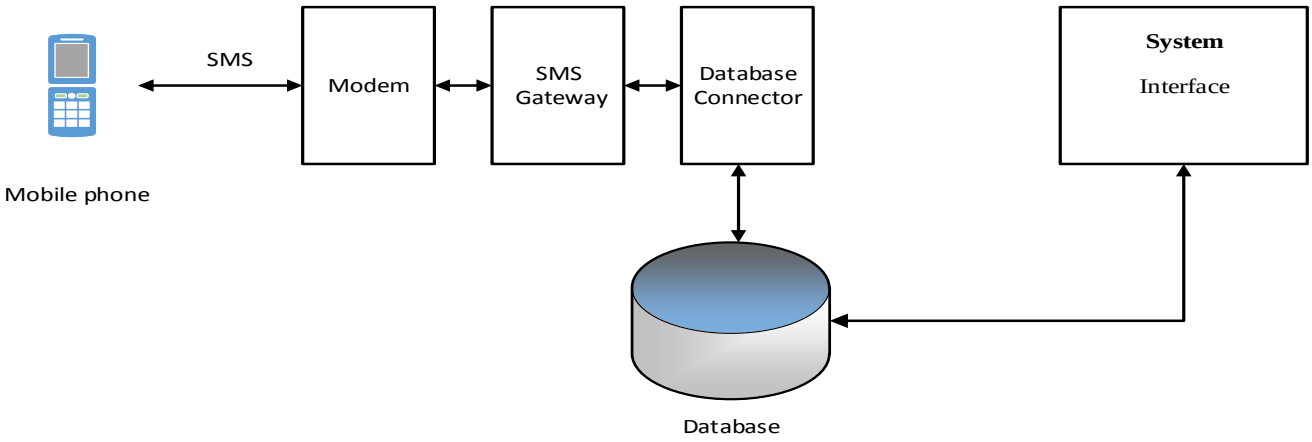

Figure 10. Connection Between SMS Gateway and Database

INTEGRATION AND TESTING

During system testing three testing techniques they have been used, which are black box testing, white box testing and performance testing. Black box testing was performed by inserting student's examination results in the system and allows them to access via SMS by sending their registration number and password to the system. The response message from the system was compared with the actual examination results, which were stored in the system. In addition, black box testing technique was used in testing the interfaces of both student and system administrator modules to see if they are working fine. Furthermore, white box testing was used during system coding to test the execution of different logical and decisions making statements. Finally, performance testing was used in testing the performance of the system by allowing twenty students to request their examination results from system concurrently, the performance of the system, increasing as the number of modems attached to the system increases but also decreases as the number of user's increases.

DEPLOYMENT OF SYSTEM

The system was developed as a prototype, which was installed in a lab environment. Student examination results were inserted in the system, and then the students were allowed to access them via both SMS and web interface.

MAINTENANCE

This system was developed as a prototype purpose to test if it is possible for students to access their examination results via SMS, apart from the internet as it is being used by existing academic records information systems in Tanzania. The SMS part of Students' Academic Records Management System with Short Message Services can be integrated into the existing systems in order to add SMS functionality. This can be achieved with minimum modification depends on the existing system architecture.

RESULTS

The results of the Students' Academic Records Management System with Short Message Services system:-

(Figure 12), is a web interface, which shows incoming SMS logs. In this panel, a system administrator can view details of all requests received in the system, such as student registration number, mobile phone number and time of the request for future reference. This panel helps network administrators to trace up system errors whenever the student claims that, he did not receive feedback from the system after request.

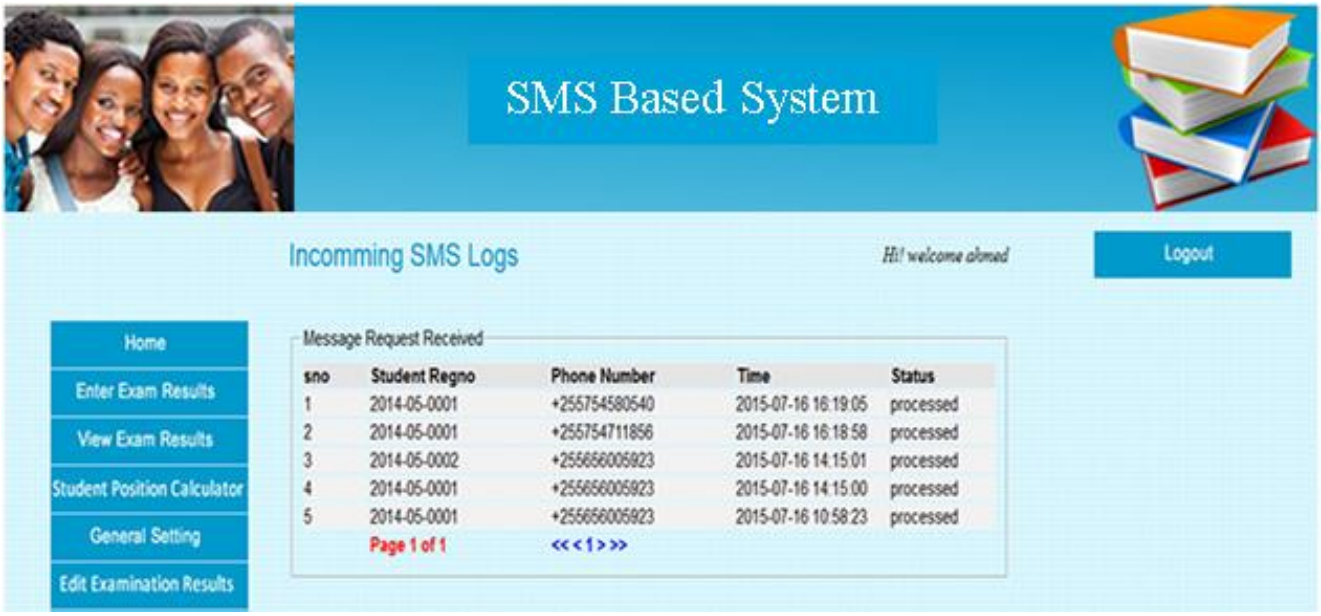

Figure 12. Incoming requests SMSs Logs

(Figure 13), is a web interface, which shows outgoing SMS logs. These are messages replied by the system after processing a request from the student. In this panel system administrator can view details all replied messages such as student mobile phone number, SMS which contains student examination results, time of reply and status, which indicates either the replied message has been received by the student or not. In addition, these panels help network administrators to trace up system errors whenever the student claims that, he did not receive feedback from the system after request.

Figure 13.Outgoing SMS Logs

(Figure 14), it is a panel, which shows student personal details and examination results. This panel opens when the student login to his account via web interfaces. From this panel student can view his or her personal details such as student name, gender, date of birth, phone number. Also student can change the password of his account as well as viewing, examination results of all semester in details. This panel it is accessible via the internet and it provides student with more details compared to the SMS part which most of the information is in a summary form.

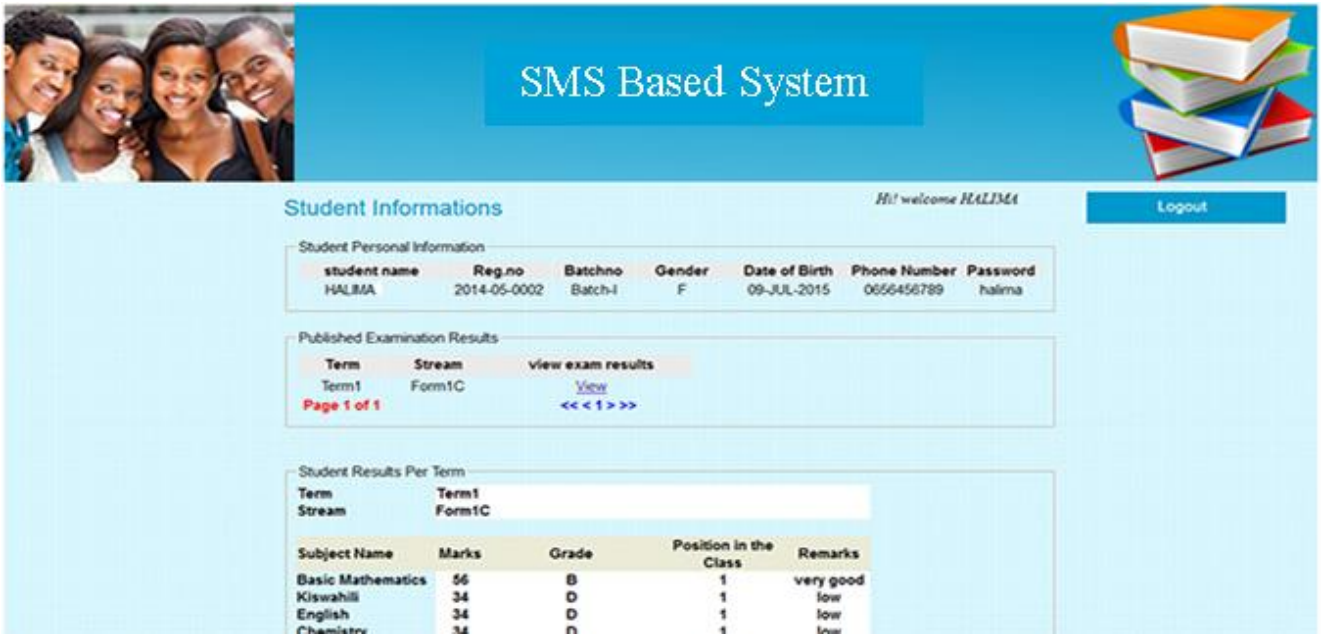

Figure 14.Student Information

SUMMARY AND CONCLUSION

A students' academic records management system with short message service, is a combination of internet and SMS access part into one unit. The SMS service, can be obtained in two ways, we can decide either to purchase the SMS gateway software and installing on our own server or purchasing the SMS service from any SMS provider companies such as Tigo, Vodacom etc. The first option increases the implementation costs and reducing recurring costs while the second option, reduces implementation costs and increase recurring costs.

RECOMMANDATION

Students' Academic Records Management System with Short Message Services system performance depends on number of modems attached to the system, number users that can be supported by the existing gateway software such as SMS gateway software and capacity of computer machine itself. I am recommending you to consider these factors during implementation of systems like this one. Furthermore, this paper focusing on building the academic records management system using SMS gateway software. This software is installed in a dedicated server purposely to route SMS between the examination results server and students' .This is a good approach if the academic institution provides SMS service for free to their students. In another way, this approach can bring some challenges if the institution need to charge their students' per SMS request they made to the system as a service charge, because it lack integration with mobile service providers payment services such as Mpesa, Tigo pesa, Airtel money etc. In order to charge per SMS it is recommended to purchase SMS gateway service from mobile service providers instead of using a dedicated SMS gateway.

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