An SMS-Based Examination Relaying System: A Case Study of Kampala International University Main Campus.

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ABSTRACT

The implementation of mobile technologies makes it possible for us to have mobile information application. With this information can be delivered and accessed via various types of portable devices immediately. Mobile information provides mobile users with versatile communication to other people and expedient notification of important events, yet with much flexibility, portability and mobility. It also permits mobile users to have access to information regardless of their physical locations. Looking to the flexibility, portability and mobility offered by mobile technologies, here in this paper we will come out with one of mobile information application called SMS based exam result relaying system. This system will enable students to have access to their exam result via mobile phones. A successful system is a system that can fulfill user satisfaction and can be accepted by the users. Usability is one of the important factors in determining user acceptance toward a new system. In order to find out the usability of the system we conducted a usability testing and distributing questionnaire. The questionnaire is based on the four usability factors such as effectiveness, learnability, flexibility and attitude to determine students' view on the SMS based exam result relaying system. The result of this study showed that the overall level of the usability for four construct (effectiveness, learnability, flexibility and attitude) in student's point of view is in the acceptable level.

Keywords: Usability, Mobile technologies, SMS-based, Mobile information.

INTRODUCTION

From accessing course materials to retrieving exam result information, all could be done ubiquitously. A study by [1; 2; 3; 4; 5; 6] showed that 62 percent of students were in favor of getting their grades sent directly to their mobile phone, rather than having to rely on the postman to ensure they are delivered on time.

The previous methods used in delivering students' exam result could be improved by applying mobile technology into it. Hence comes the introduction of mobile-result – an application of delivering students' exam information in mobile computing environment [7; 8; 9; 10]. Besides that, the implementation of this prototype offered students with more alternative medium in getting their result information [4; 5; 11; 12; 13].

Short Message Service (SMS) is a text messaging service component of the phone, web, or mobile communications systems using standardized communication protocols that allow the exchange of short text messages between fixed line or mobile phone devices [6; 7; 8; 14; 15; 16; 17].

SMS as used on modem handsets was originated from radio telegraphy in radio memo pagers using standardized phone protocols and later defined as part of the Global System for Mobile Communications (GSM) series standards in 1985 as a means of sending messages of up to 160 characters to and from GSM mobile handsets [9; 10; 18; 19; 20]. Since then, support for the service has expanded to include other mobile technologies such as ANSI CDMA networks and Digital AMPS, as well as satellite and landline networks [11; 12; 21; 22; 23]. Most SMS messages are mobile to mobile text messages though the standard supports other types of broadcast messaging as well [13]. SMS

Based Examination Results Relaying System is an SMS - based system that will enable campus students to receive their results on their mobile handsets by simply sending specific information to the system [14]. Development tools for this system will include a personal computer running on a windows operating system, a GSM modem, an SMS enabled phone, an SMS engine software, and a system application developed using Java software.

Statement of the Problem

Due to the increased cost of living such as increased transport costs among others, there is a growing need to bring services closer to people. Such services may include information. Thus given the situation where students have to individually pick and view their results, it is instead easy and cheaper for them to view their results via mobile phone using SMS technology compared to physically picking and viewing them. Thus Short Messaging Service can be used to bring exam results information closer to the people.

Aim of the Study

The aim of the study was to enable students receive and view their examination results via mobile phones using SMS technology.

Specific objectives

- To design, develop, and implement and examination results relaying system interface and databases.
- To configure a GSM modem to enable sending messages to and from the examination results relaying system.
- To ensure privacy while viewing individual examination results.
- To bring about flexibility in receiving and viewing examination results from any location.
- To reduce on crowds at faculty offices while picking and viewing results.

Research Questions

- How flexible is it for students to receive and view their results?

Scope of the Study

The study was carried out at Kampala International University main campus

- How does the current system ensure privacy for students viewing their results?
- How is crowding at faculty offices while students are receiving and viewing their results handled?
- How will the system interface and database be designed?
- How will results be sent to students?

Significance of the Study

Present and future scenarios of the learning process claim students to be mobile. The availability of this mobile application could support students' mobility. The introduction of this application could fulfill students' mobility because it enables students to retrieve their exam result via their mobile devices. Flexibility is one of the features of this application. This feature enables students to apply this application anytime and anywhere they want. Furthermore, the architecture of the system provides real-time feedback, means that student can get exam result immediately.

Besides that, the implementation of this service will offer students with various alternatives in receiving and viewing their result information. Besides relying on the PC or paper, queuing up at faculty offices or relying on notice boards for students to view there results, now students can get their result information through mobile devices. The system will also benefit student in the way of its deployment because it does not require any special software to be installed in student mobile phone.

This project also has significant value for the lecturers. For the lecturers this service will reduce their workload in managing student results. In this application results will be stored in a database and it is easy for the lecturers to update any changes. In addition, through this application students request will be automatically served by the system. This system requires less monitoring by system administrator.

METHODOLOGY

under the College of Applied Sciences and Technology. This project took about six months to be completed. The first three

months were used for data collection and analysis. The following three months were used to design the actual system that was then implemented and tested to see if it met the set objectives. The respondents in this study were students from the College of Applied Sciences and technology. SMS technology was be used in developing the system and GSM technology was applied. A mobile phone with the ability to send and receive messages was used to test the new system. Testing the usability of the system was based on four usability factors namely effectiveness, learnability, flexibility and attitude.

Data Collection
Data collection refers to techniques that are used to collect data. Below are some methods of data collection that were used: interview, questionnaires and observation.

Project planning and feasibility study.
Planning establishes a high level view of the intended project and determines its goals, it involves planning for the following;

User requirements
User requirements are requirements that are not full filled by the current system hence not satisfying the needs of the current user of the system. In our case there is a need for users of the current system to acquire their results fast, a need which is not fulfilled by the current system.

Hardware requirements
The hardware that will be used in this project will involve computers that will act as servers to run the developed system, a GSM modem that will be useful in the forwarding of sent and received messages to and fro the system and finally a mobile phone that will provide the interface for writing, reading, sending and receiving messages.

Software requirements
The software requirements that will be used in this project are Java software that will be used to develop the system interface, My SQL server software will be used to develop the system database that will store student information and Now SMS software that will act as a middleman to the modem and the system on the server computer.

System Analysis.
Designing the system
The system will be designed using a windows based personal computer. A GSM modem will be used to enable the sending and receiving of messages. Java software and Java programming language will be used in designing the application/system interface and MySQL be used to design the application databases. Ozeki SMS software will be used and a middle ware to manage the interfacing of the GSM modem and system applications.

Usability testing
The system will be tested by the user to check if the user requirements are tested. If the user sends a valid request SMS to the system, he should get three things;

- A reply SMS
- Correct examination results
- Readable examination results

If he sends an invalid request SMS to the system, the system should respond with a proper failure SMS message.

Implementation and maintenance
The implementation of the system will be done in the college of applied sciences and technology after it has been tested. This process will follow parallel implementation method where the new system will be implemented alongside the current system. The system will be maintained by a system administrator for the college.

RESULTS

Demographic characteristics of the sample
The demographic characteristic of the sample is characterized in the table below

and is based on the eight questions from the questionnaire. All the questionnaires were responded to so in total there were 200 respondents.

Demographic characteristic of the respondents
QUESTION ONE
Table 1: Showing sample population to be either satisfying or dissatisfying

QUESTION	FREQUECY	% SHARE
How do you find the current system of receiving results?		
Very satisfying	50	25%
Satisfying	30	15%
Least satisfying	100	50%
Dissatisfying	20	10%
Total	200	100%
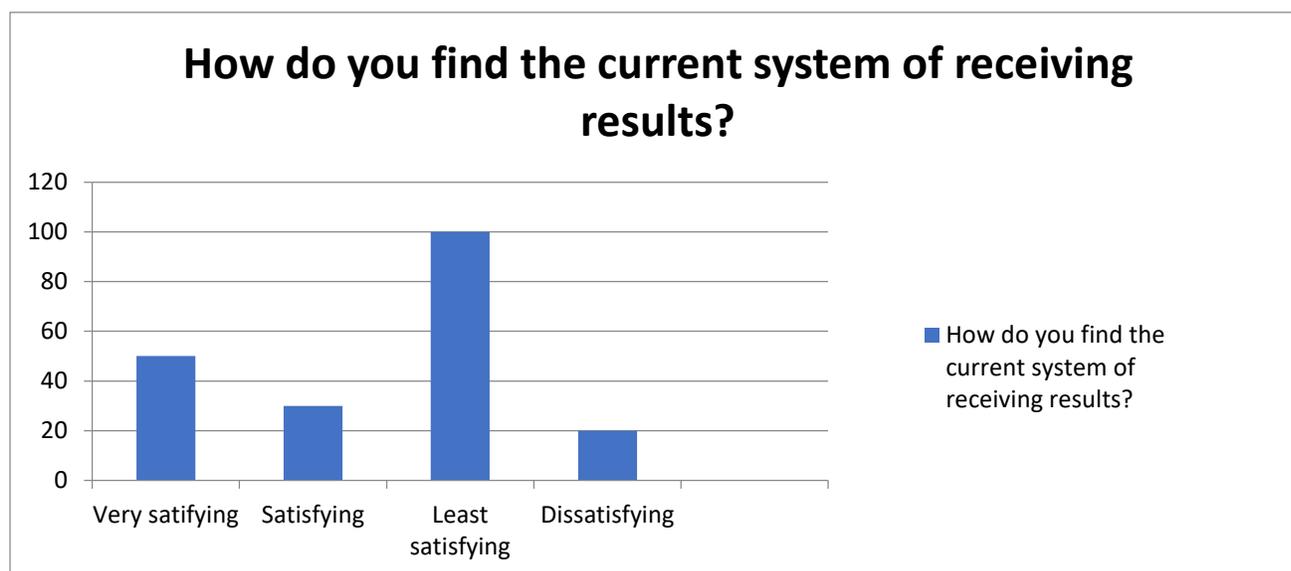
Fig 1: How do you find the current system of receiving results?

According to the table and the graph above 25% of the sample population found the current system very satisfying. Literary that is a quarter of the sample population. 15% of the sample population found the system satisfying, 50% the sample population found the system least satisfying and 10% of the population found the system dissatisfying.
So half of the population did not approve of the current system and would like to see new improvements made to it.

QUESTION TWO
Table 2: How easy is it for you to receive your results using the current system?

REMARKS	FREQUECY	% SHARE
Easy	20	10%
Very Easy	30	15%
Difficult	100	50%
Very Difficult	50	25%
Total	200	100%

## How easy is it for you to receive your results using the current system?
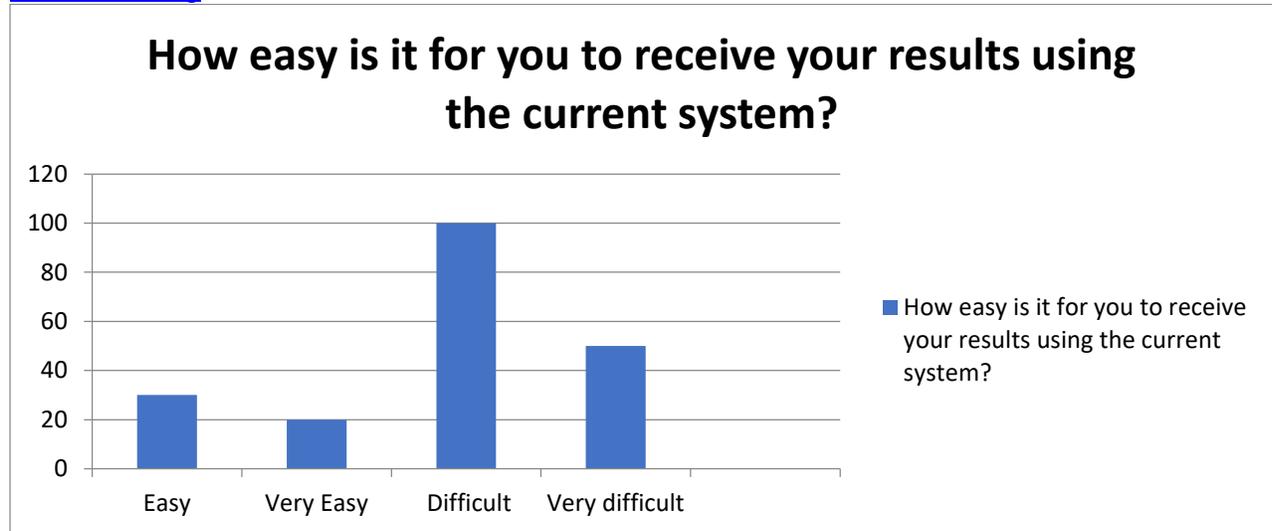
Fig 2: How easy is it for you to receive your results using the current system?

In this question we found out that 10% of the sample population found it easy to receive their results and 15% found it very easy but on the hand 50% of the sample population found it difficult to find there results and 25% of this very population found it very difficult.

So a big number of the students found some sort of difficulty when receiving there results which implies that improvements on the current system have to be made to tackle student issues.

QUESTION THREE:

Table 3: How do you acquire your results?

REMARKS	FREQUECY	% SHARE
Email	20	10%
SMS	90	45%
Website	50	25%
Notice boards	20	10%
Head of department	20	10%
Total	200	100%

# How do you prefer to acquire your results?
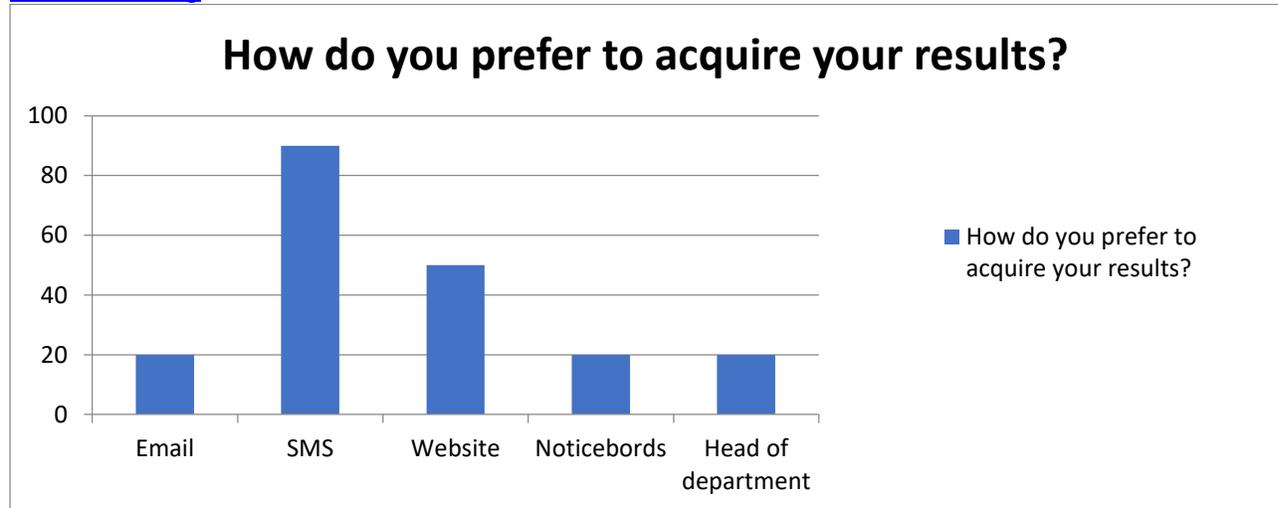
Fig 3: How do you prefer to acquire your results?

When asked how they would prefer to acquire there results, majority preferred SMS. 10% of the population preferred email, notice boards and head of department while 25% preferred to receive their results through a university website.

Therefore if the current system was to be improved, the use of SMS and university website to acquire results would have to be taken into consideration.

QUESTION FOUR:
Table 4: What would you prefer to do first?

REMARKS	FREQUECY	% SHARE
Get your result slip first and then see your results	90	45%
See your results first and then get your results slip second	110	55%
None of the above	0	0%
Total		100%

# What would you prefer to do first?
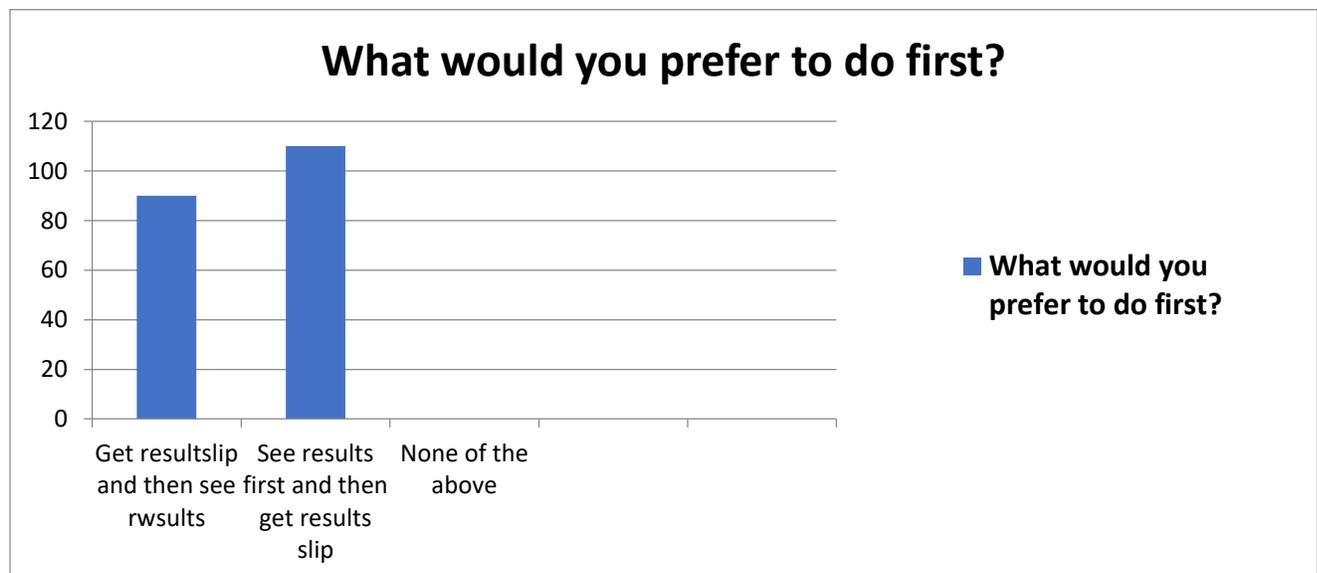
Fig 4: What would you prefer to do first?

When asked the above question, majority preferred to have a glance of their results before they could actually have a glance at their actual results slip.

QUESTION FIVE:
Table 5:

| QUESTION	FREQUECY	% SHARE
1. What is required of you in order to acquire your results?		
University ID	50	25%
Previous semester Ledger	100	50%
No retakes from previous semester	50	25%
None of the above	0	0%
Total	200	100%
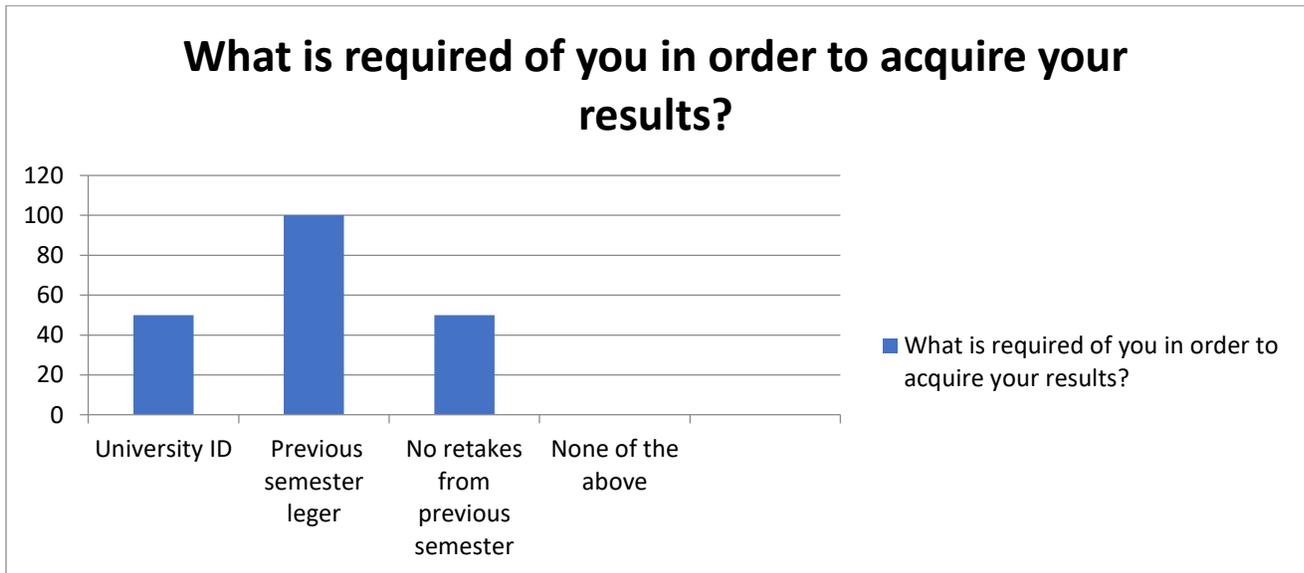
Fig 5: what is required of you in order to acquire your results?

QUESTION SIX:

Table 6: Which Mobile network do you often use?

REMARKS	FREQUECY	% SHARE
MTN	100	50%
WARID	50	25%
UTL	10	5%
AIRTEL	40	20%
TOTAL	200	100%

## Which Mobile network do you often use?
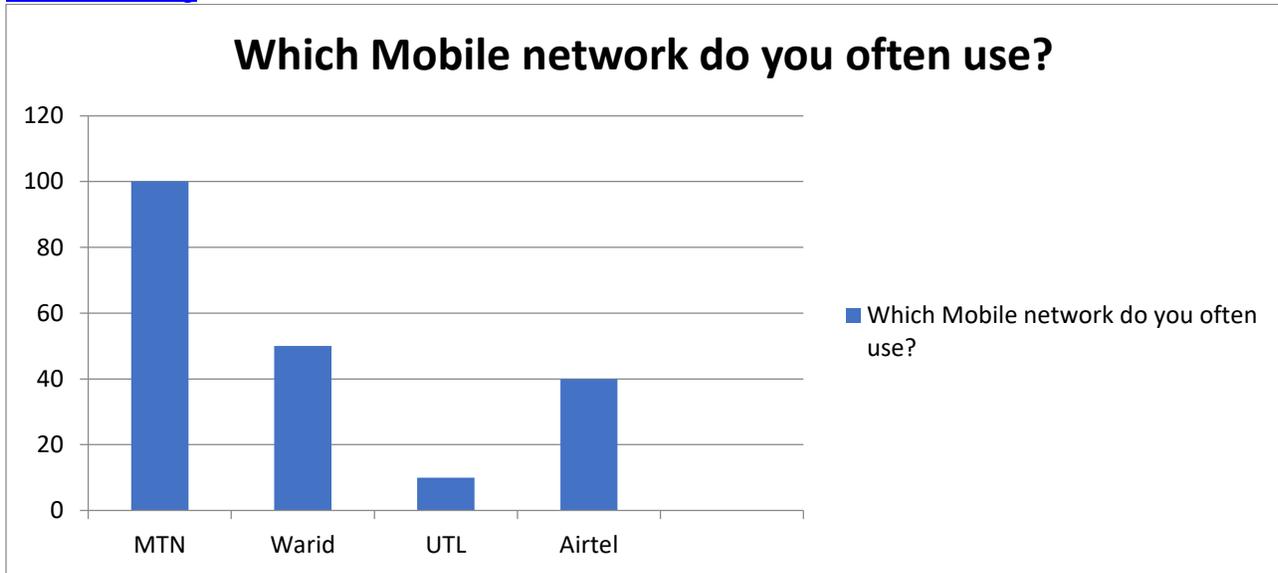
Fig 6: which mobile network do you often use?

QUESTION SEVEN:
Table 7: What better ways would you prefer to use to receive your results and why?

REMARKS	FREQUENCY	%SHARE
Email	40	20%
SMS	70	35%
Campus website	60	30%
Notice board	30	15%
Head of department	0	0%
TOTAL	200	100%

What better ways would you prefer to use to receive your results and why?
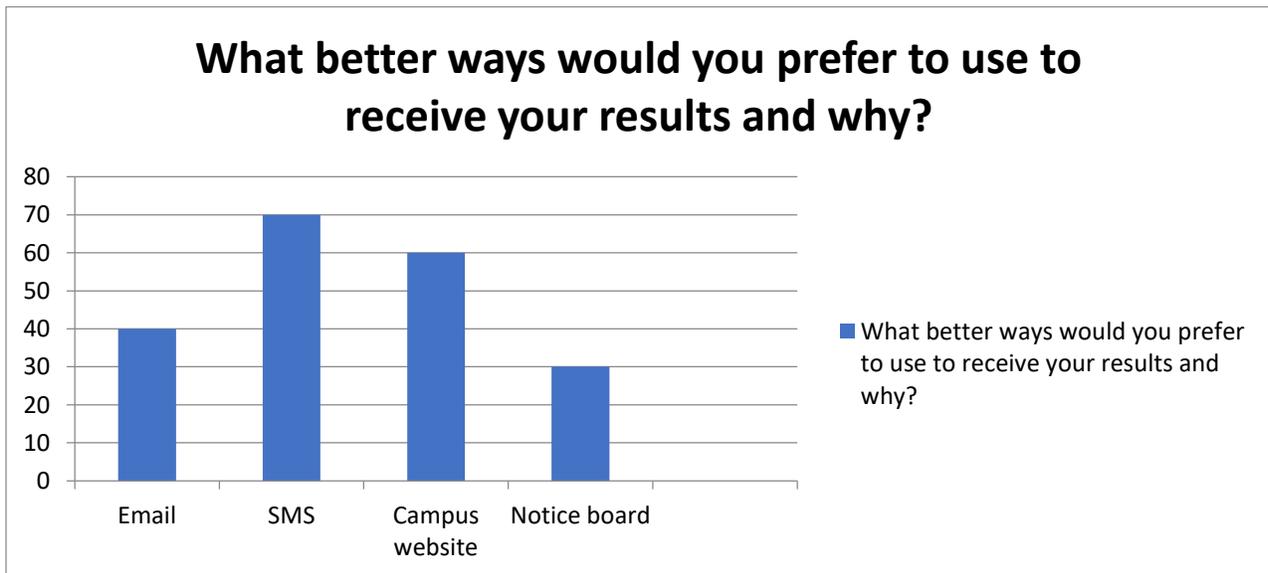

Fig 7: what better ways would you prefer to use to receive your results and why?

QUESTION EIGHT:
Table 8: Is there a possibility for some else to acquire someone else's results?

| REMARKS	FREQUENCY	%SHARE
Very unlikely	30	15%
Unlikely	10	5%
Not sure	10	5%
Likely	40	20%
Very likely	30	15%
Total	**200**	**100%**
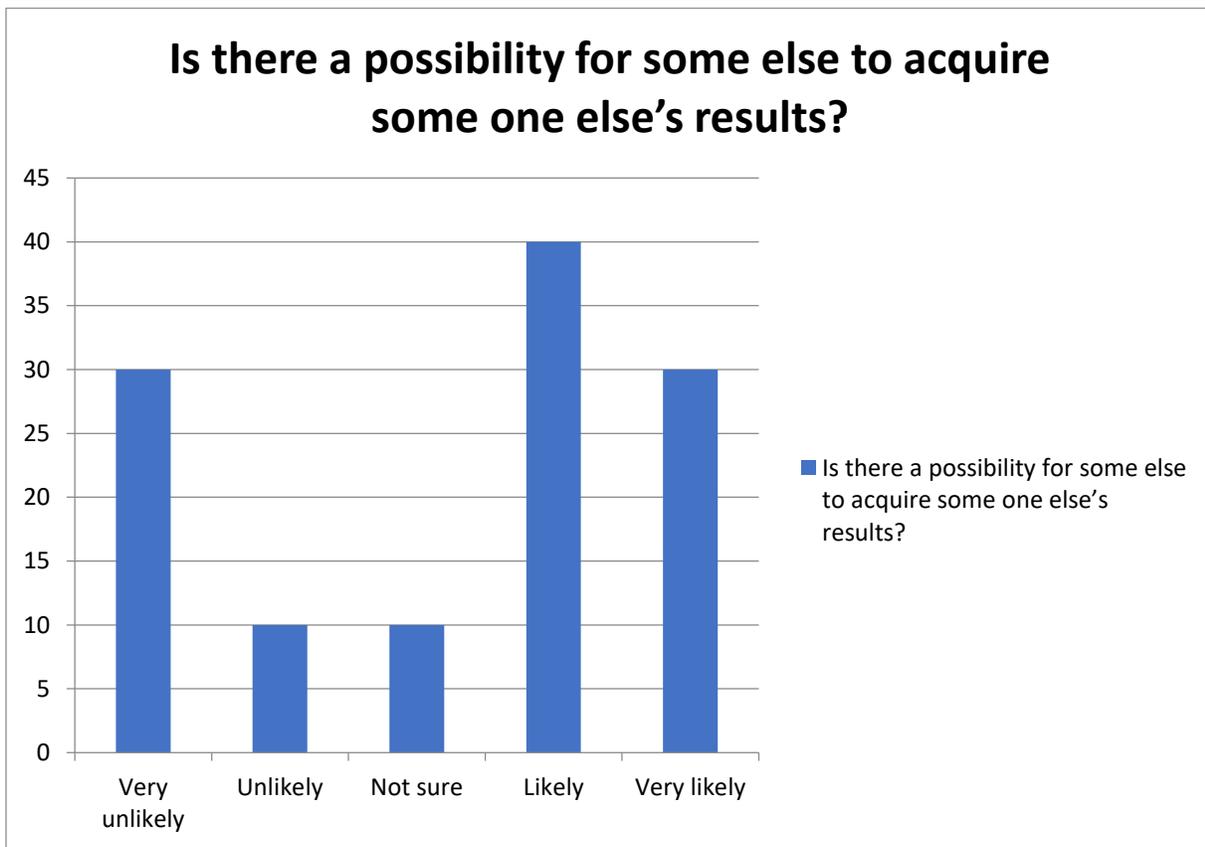
Fig 8: Is there a possibility for some else to acquire someone else's results?

SYSTEM DESIGN AND IMPLEMENTATION

Conceptual Model of the new working system.

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  ┌──────────┐        ┌──────────────┐              ┌──────────────┐
  │   HOD    │        │   FACULTY    │              │   PROGRAM    │
  └──────────┘        │ ADMINISTRATOR│              │  LECTURERS   │
                      └──────────────┘              └──────────────┘
          ╲                  │                        ╱
           ╲                 ↓                       ╱
            ↘      ╭────────────────────╮          ↙
                   │     SMS BASED       │
                   │    EXAMINATION      │
                   │      RESULTS        │
                   │     RELAYING        │
                   │      SYSTEM         │
                   ╰────────────────────╯
                        │        ↑
                        ↓        │
                   ┌──────────────┐
                   │     SMS      │
                   │   GATEWAY    │
                   └──────────────┘
                        │     ↑
                        ↓     │
                   ┌──────────────┐        ┌──────────────┐
                   │    GSM       │ ←──────│    USER      │
                   │   MODEM      │        │    PHONE     │
                   └──────────────┘ ──────→└──────────────┘
```
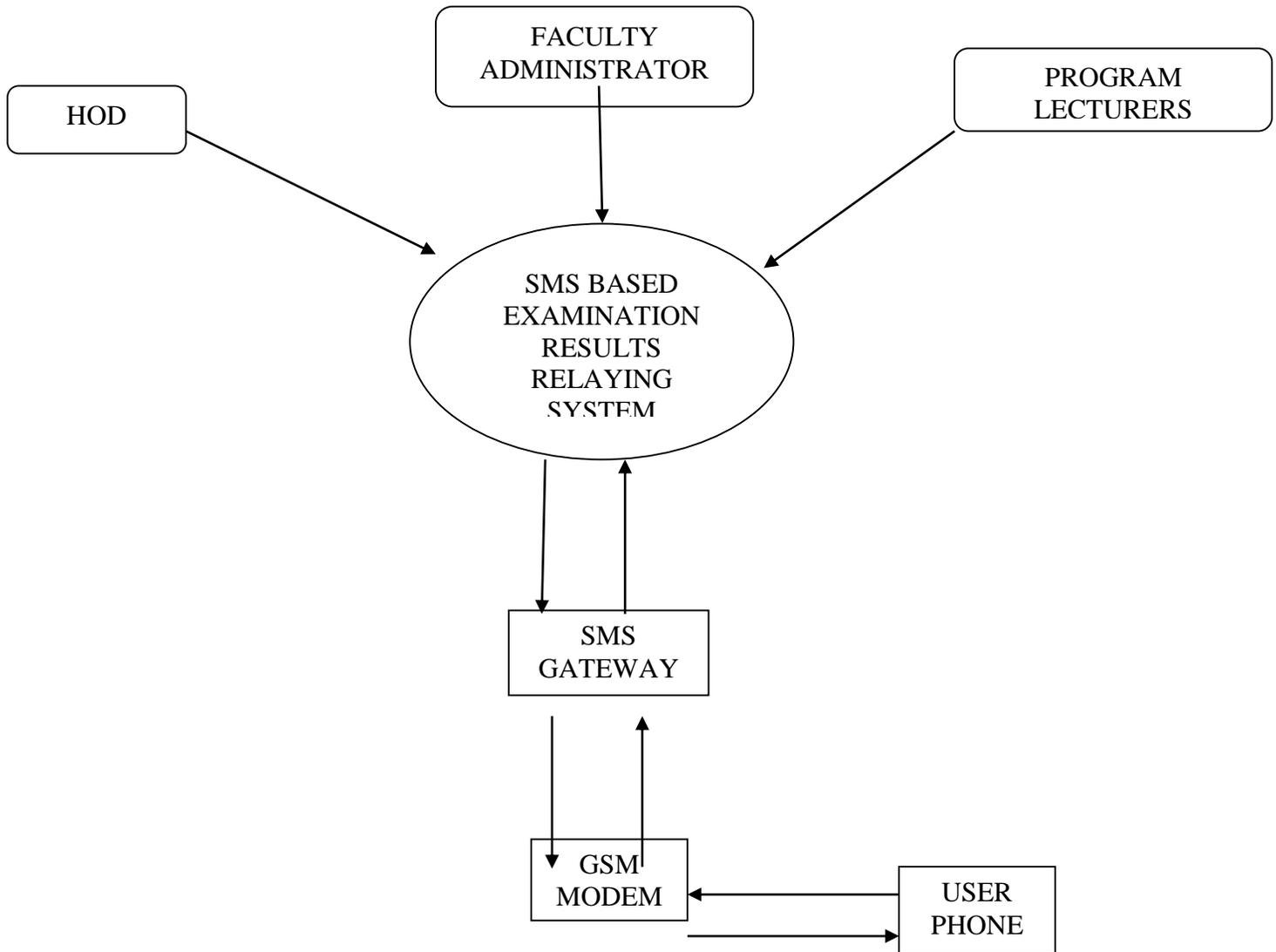
Fig 9: Conceptual Model Diagram

Physical Design

The physical design involved the creation of database tables to capture data entered into the new system.

The table layout of related elements looked as shown below;

TABLE 9: Courses.

Column	Type	Null	Default	Comments
program	varchar(5)	No		
year	varchar(10)	Yes	*NULL*	
semester	varchar(10)	Yes	*NULL*	
code1	varchar(10)	Yes	*NULL*	
unit1	varchar(100)	Yes	*NULL*	
code2	varchar(10)	Yes	*NULL*	
unit2	varchar(100)	Yes	*NULL*	
code3	varchar(10)	Yes	*NULL*	
unit3	varchar(100)	Yes	*NULL*	
code4	varchar(10)	Yes	*NULL*	
unit4	varchar(100)	Yes	*NULL*	
code5	varchar(10)	Yes	*NULL*	
unit5	varchar(100)	Yes	*NULL*	
code6	varchar(10)	Yes	*NULL*	
unit6	varchar(100)	Yes	*NULL*	
code7	varchar(10)	Yes	*NULL*	
unit7	varchar(100)	Yes	*NULL*	

TABLE 10: Students

Column	Type	Null	Default	Comments
surname	varchar(20)	Yes	*NULL*	
other names	varchar(30)	Yes	*NULL*	
dob	varchar(20)	Yes	*NULL*	
age	varchar(10)	Yes	*NULL*	
gender	varchar(10)	Yes	*NULL*	
nationality	varchar(20)	Yes	*NULL*	
Phone number	varchar(20)	Yes	*NULL*	
email	varchar(40)	Yes	*NULL*	
program	varchar(10)	Yes	*NULL*	
reg_n0	varchar(30)	No		
year	varchar(10)	Yes	*NULL*	
semester	varchar(10)	Yes	*NULL*	
session	varchar(10)	Yes	*NULL*	
Year of admission	varchar(10)	Yes	*NULL*	
Mode of entry	varchar(10)	Yes	*NULL*	
Date of entry	varchar(10)	Yes	*NULL*	

TABLE 11: Results

Column	Type	Null	Default	Comments
program	varchar(5)	Yes	*NULL*	
reg_n0	varchar(30)	No		
year	varchar(10)	Yes	*NULL*	
semester	varchar(10)	Yes	*NULL*	
code1	varchar(10)	Yes	*NULL*	
unit1	varchar(100)	Yes	*NULL*	
code2	varchar(10)	Yes	*NULL*	
unit2	varchar(100)	Yes	*NULL*	

code3	varchar(10)	Yes	NULL
unit3	varchar(100)	Yes	NULL
code4	varchar(10)	Yes	NULL
unit4	varchar(100)	Yes	NULL
code5	varchar(10)	Yes	NULL
unit5	varchar(100)	Yes	NULL
code6	varchar(10)	Yes	NULL
unit6	varchar(100)	Yes	NULL
code7	varchar(10)	Yes	NULL
unit7	varchar(100)	Yes	NULL
cw	int(11)	Yes	NULL
ex	int(11)	Yes	NULL
tt	int(11)	Yes	NULL
lg	varchar(5)	Yes	NULL
gp	varchar(5)	Yes	NULL
cw2	int(11)	Yes	NULL
ex2	int(11)	Yes	NULL
tt2	int(11)	Yes	NULL
lg2	varchar(5)	Yes	NULL
gp2	varchar(5)	Yes	NULL
cw3	int(11)	Yes	NULL
ex3	int(11)	Yes	NULL
tt3	int(11)	Yes	NULL
lg3	varchar(5)	Yes	NULL
gp3	varchar(5)	Yes	NULL
cw4	int(11)	Yes	NULL
ex4	int(11)	Yes	NULL
tt4	int(11)	Yes	NULL
lg4	varchar(5)	Yes	NULL
gp4	varchar(5)	Yes	NULL
cw5	int(11)	Yes	NULL
ex5	int(11)	Yes	NULL
tt5	int(11)	Yes	NULL
lg5	varchar(5)	Yes	NULL
gp5	varchar(5)	Yes	NULL
cw6	int(11)	Yes	NULL
ex6	int(11)	Yes	NULL
tt6	int(11)	Yes	NULL
lg6	varchar(5)	Yes	NULL
gp6	varchar(5)	Yes	NULL
cw7	int(11)	Yes	NULL
ex7	int(11)	Yes	NULL
tt7	int(11)	Yes	NULL
lg7	varchar(5)	Yes	NULL
gp7	varchar(5)	Yes	NULL

TABLE 12: Sms_results

Column	Type	Null	Default	Comments
keyword	varchar(30)	Yes	NULL	
message	varchar(1000)	Yes	NULL	

System Testing

Here program modules are to be tested to eliminate any errors that may exist. The new system is also tested to check if it's compatible with the hardware it's intended to run on. The testing process can be viewed as part of the training exercise as it also involves users for familiarity and accreditation.

The modules were tested by using them to collect and enter data into the data. Student personal information, course unit information and results of one student were collected and inserted into the database. An SMS server called OZEKI SMS was interfaced with the system database and programmed to retrieve data from the database based a given keyword. A modem was installed and configured to work with the SMS software. Once an SMS containing a keyword such as a registration number was sent, it was received by the SMS software installed on the PC and the content of the SMS were compared with those in the results database and once a match was found the results associated with the keyword were retrieved, converted into and SMS and then sent back to the recipient.

System Implementation

SMS Send Method

The user of a mobile phone will have a text containing a keyword to the system. This keyword will be no longer than 160 characters. These characters can be text (alphanumeric or binary Non-Text Short messages).

SMS Process Method

Once the SMS message is received by the SMS sever on the client computer, it's stored in a central short message center. Since the message contains a keyword, the keyword will be processed by comparing it with the one in the results database. If it matches, the results associated with the keyword will be retrieved and if it does not match with any key word in the database, then no keyword will be retrieved.

SMS Reply Method.

The retrieved results will then be converted in to a text of no more than 160 characters and will be sent to sent to the recipient using the same mobile phone number. If the text is more than 160 characters the recipient should expect two or more SMS messages. And if the recipient's number is not available, then the message will be stored in the short message center and sent letter.

Flow of the system
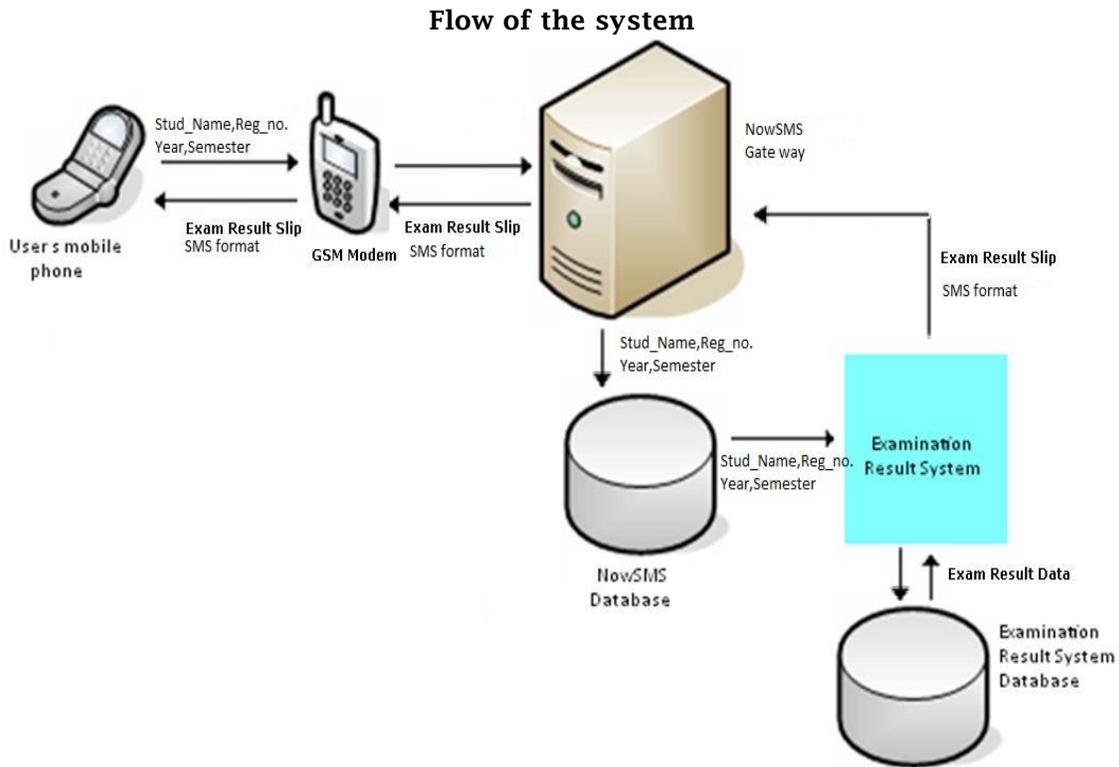
Fig 10: Diagram showing results are retrieved from a results system using an SMS

Connecting modem to PC

A DSL modem is to be connected to the PC. Since its external it is connected using special networking cables and the process of setting is shown below;

- Power off both the computer and the modem
- Connect the Ethernet cable to the modem
- Plug the other end of the cable into the computer

- With the modem and computer connected by the Ethernet cable, turn on both the modem and the computer. Boot the computer and configure Internet access. Allow the computer to fully boot up, then configure the machine's Internet access using the instructions provided by your DSL service provider

SMS Exam Results System (Server side)
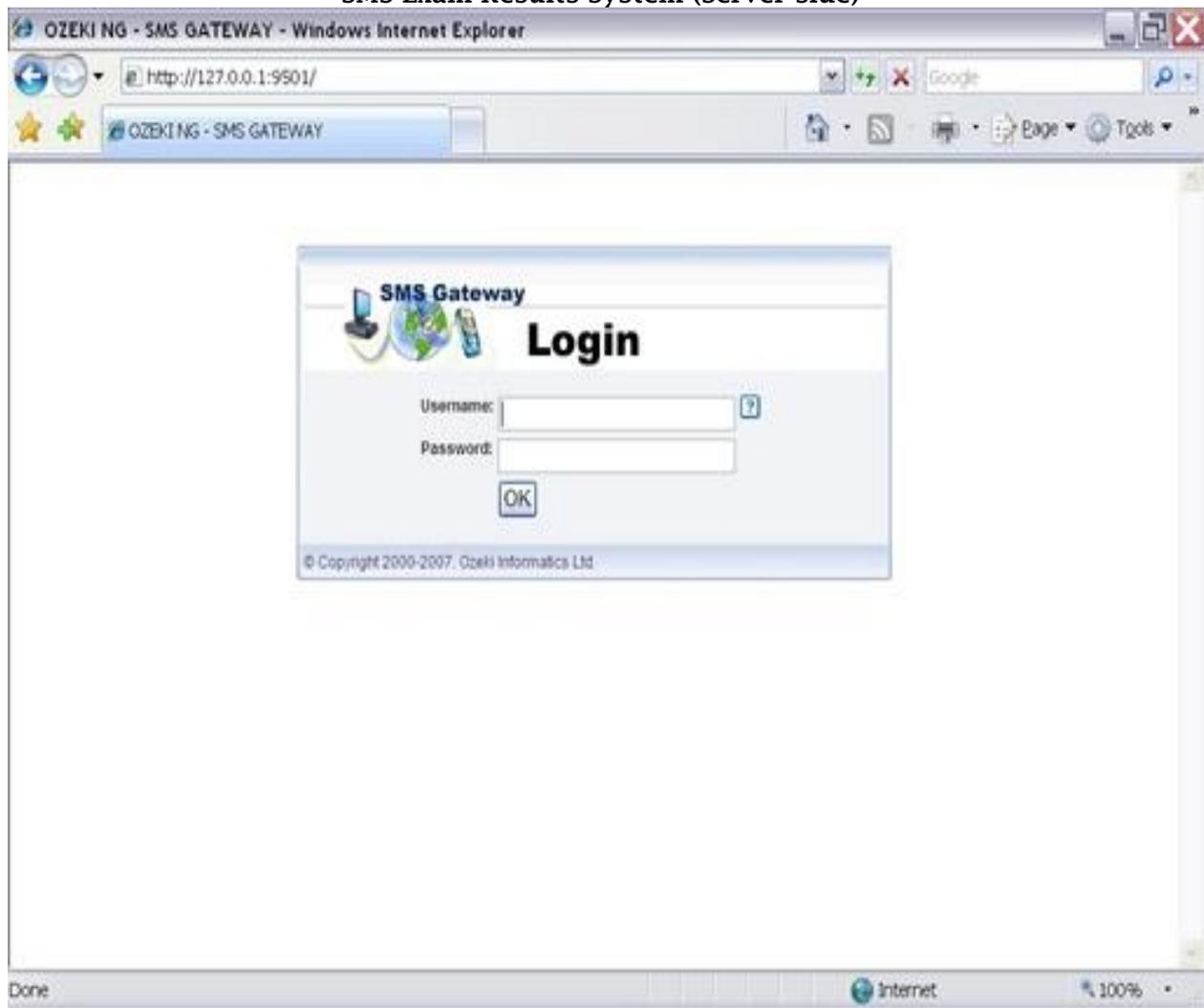
Fig 11: Login Window.
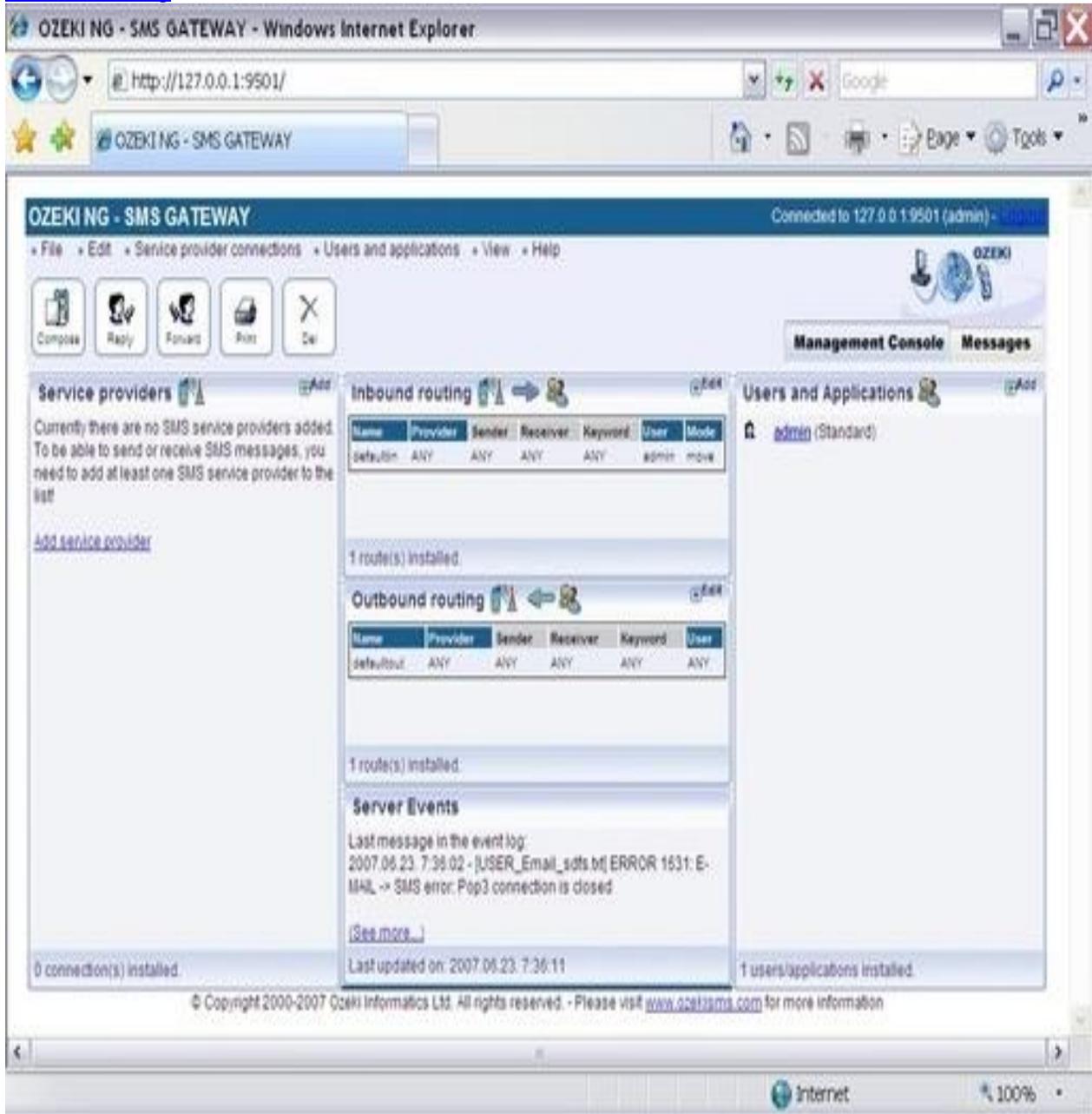
Fig 12: Management Console.
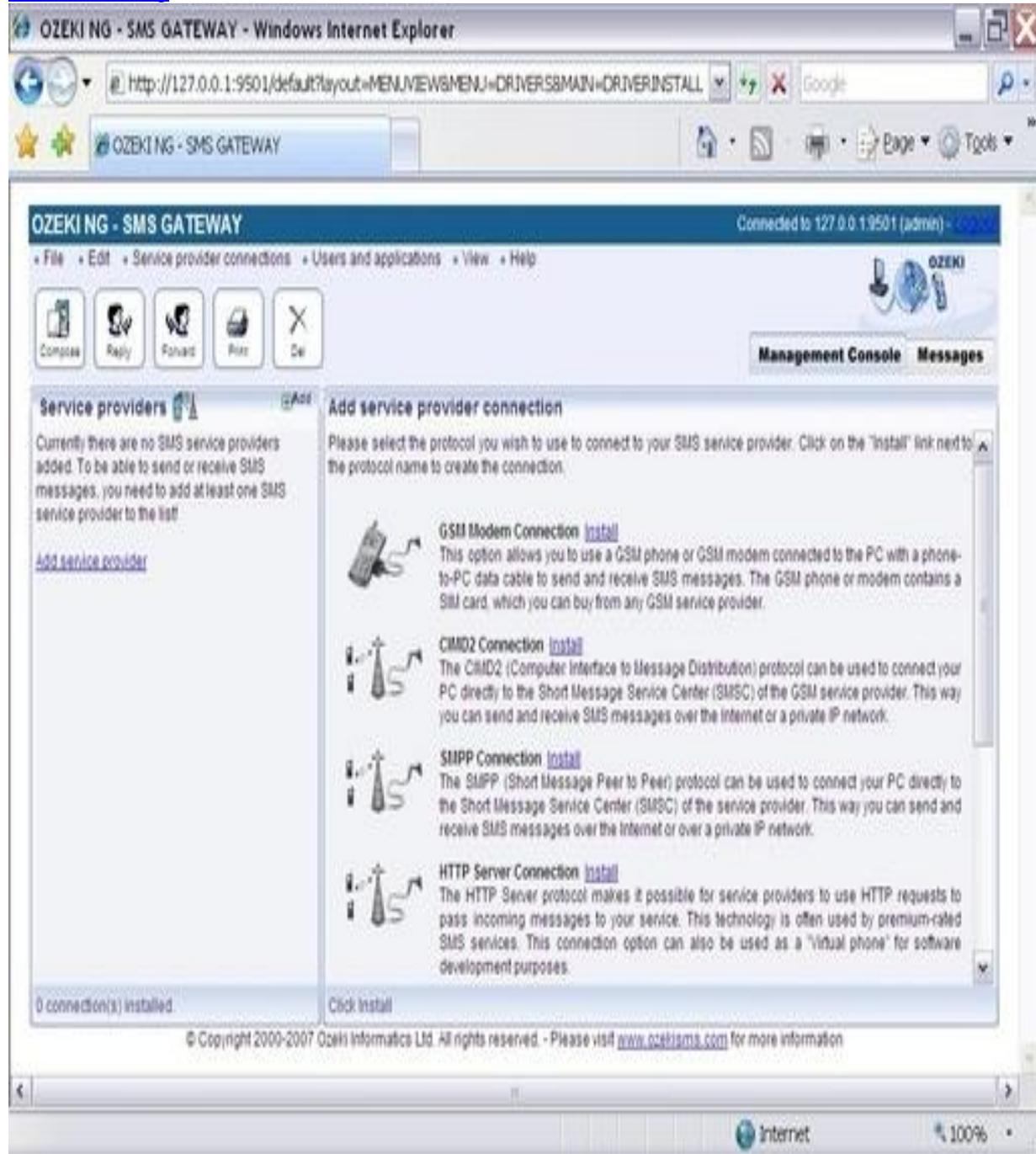
Fig 13: Add Service Provider Connection Window.

Fig 14: Add User or Application Window
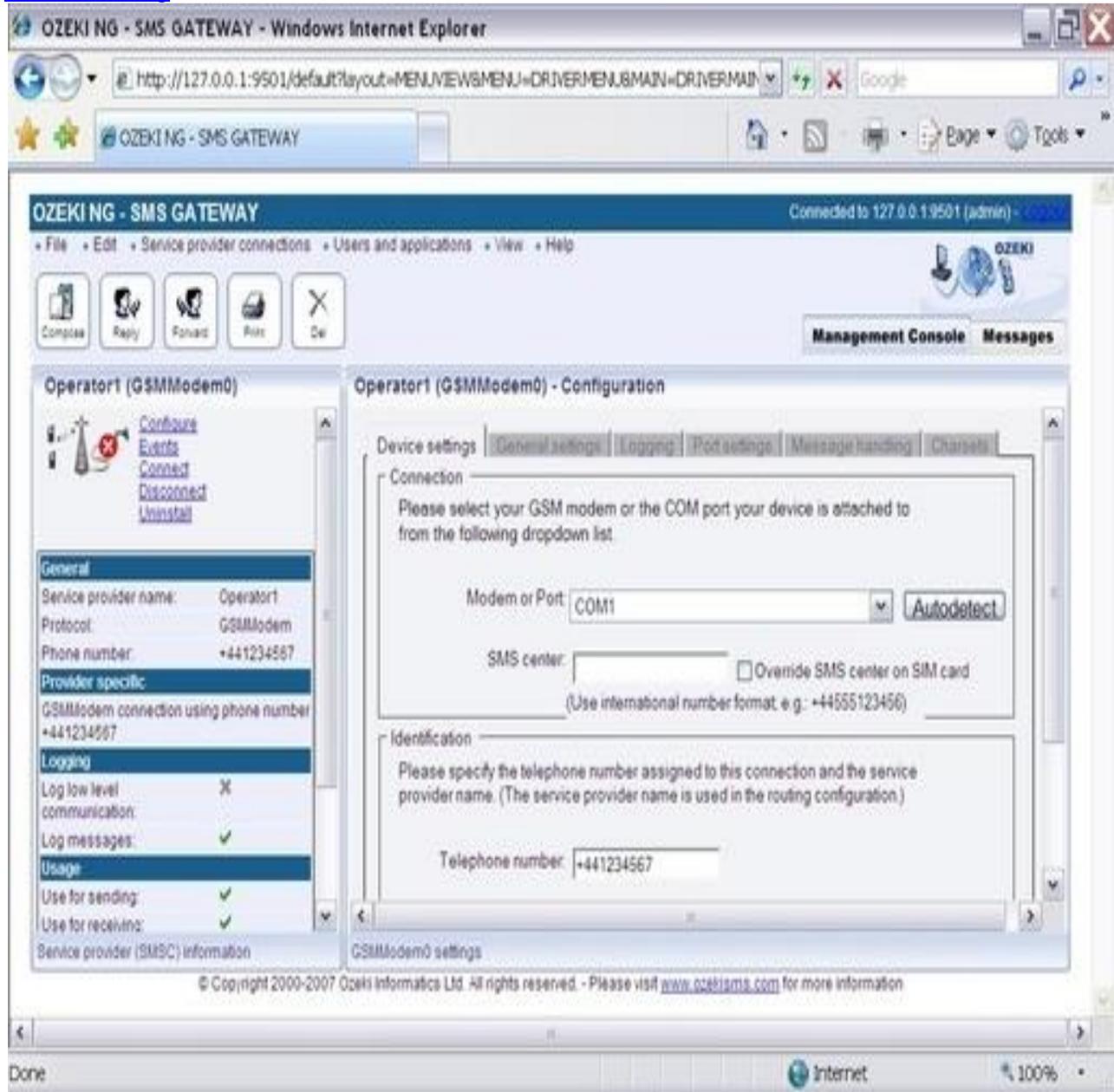
Fig 15: Configuring Modem Window

SMS Exam Results System (Client side)
When the system is run three a login form will appear to prompt user to enter Password. If the password is not valid a message will appear saying invalid username and password and if it is valid a tabbed form containing all the three forms will appear. The above said forms will look like as show below.

Fig 16: Login Form

The Three Tabbed Forms

Fig 17: Course Registration Form

Fig 18: Student Registration Form

Fig 19: Results Entry Form

Database Installation

The system will use a My SQL database to run and store data collected using the above forms. My SQL is free open source database software that can be downloaded from the internet for free. This will interface with the modules using java code.

A My SQL Connector/ODBC 5.1 was installed and used by the java application to communicate with My SQL database.

Compiling Packaging

For the application to run independently of the java IDE, it's compiled and stored in a distribution folder. It's this folder that is moved from one machine to another. The application is run from inside the folder and a My SQL database has to be running before the application is started. For the application to run more efficiently on any machine, a java development kit has to be installed first.

23

DISCUSSION

The Effectiveness of the SMS Exam Results Relaying System.

With the rising adoption of mobile phone with 3G and wireless connections among students, it's not surprising that students prefer to use their mobile devices as messaging tools so the effectiveness of the SMS system is high because it's easy for students to simply send and SMS.

Also the use of SMS is to some extent cost effective as mobile subscription plans come with free SMS bundles thus no additional cost of sending SMS

Students want to see their results fast once they are notified that they are out. So the system becomes effective once the student sends an SMS to the system and immediately receives an SMS containing the requested results.

The fact that the system provides a response automatically makes the whole setup effective. When a student queries the system for results the students receives an automatic reply because the system is automated.

Learnability of the SMS Exam Results Relaying System

The system will be specifically used to receive results once they are available by simply querying the system using a keyword.

The system interfaces are easy to learn with exception of the SMS interface which with a little training will be adapted to.

Flexibility of the SMS Exam Results Relaying System

Since no special training is required to teach students on how to send results, it becomes practically easy for students to send SMS and receive results from anywhere at any given time. Plus it is also easily accessible any time and from anywhere which makes it flexible

CONCLUSION

With the current trend of using SMS to communicate and ease of using SMS technology to communicate, the student attitude toward using SMS exam results relaying system is positive with no bias.

RECOMMENDATION

For effective performance of this system and continuous development of the system we advocate that University should;

- Invest in more research/study be done on the study area to determine the rate of growth of the university to enable better data validation refinement,
- Insist on more logical security concern to be undertaken to open doors for internet database connection as with the existing data storage capabilities in the internet

the university will save even further in data storage,

- Continuously encourage system usage by observing the use of the system, conducting user satisfaction surveys and meetings, providing additional training, and logging enhancement ideas,
- Invest in better backing up techniques and data recovery software's for reduce system down time and increase its durability and reliability.

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