

Fostering Distance Training Programme (DTP) Students' Access to Semester Examination Results via SMS at University of Rwanda-College of Education

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Abstract

This paper presents a situation analysis and implementation of Distance Training Programme (DTP) Semester Examination Results Access (SERA) through Short Message Service (SMS) available anytime and anywhere. 'Texting' or SMS mobile phone messaging is rapidly increasing communication in business and community service. The prompting scenario addressed in this paper is the release of semester examination results (marks) at one and only one place: The UR-CE main campus notice board, regardless of the geographical dispersion of intended audience: The DTP students. To study the DTP students' access to semester examination results via mobile SMS implementation possibilities, analysis of available telecommunication infrastructures, and services coverage in the country (Rwanda) was done. Then a survey was conducted on the information system implementation status at UR-CE, and the DTP management staff and students perceptions toward mobile SMS to support DTP administration communications. In the paper we discuss the inclusion of SMS technology among the DTP administration communication channels to permit DTP students at UR-CE access the semester examination results through mobile SMS technology. The SMS pull method is proposed for implementation in regards to the SERA communication. The implementation success of DTP semester examination results access via SMS is likely to improve the communication to both DTP administration and students sides.

Keywords: Distance Training Programme, DTP, UR-CE, Semester Examination Results Access, SERA.

1. Introduction

A survey of DTP management staff and students perceptions on mobile SMS technology to support offline distance learning communications activity at the University of Rwanda shows 100% of DTP students own mobile phones, of which 95.1% of the students use mobile phones for texting among other services [1]. SMS is largely used for personal communication as well as for education communication purposes among DTP students. The available telecommunication technologies, infrastructures and services coverage in Rwanda; as illustrated in Table 1 and 2; with a mobile and the Internet penetration rate of 65% and 22%, respectively [2], are the driving factors to provide UR-CE students direct access to semester examination results in general and to DTP students in particular via SMS technology.

Table 1: Mobile Network Coverage in June 2014.

Source: www.rura.gov.rw.

	2G	2.5G	3G	3.5G
Geographic coverage				
MTN Rwanda Ltd	99.08	99.08	54.67	54.67
TIGO Rwanda Ltd	87.9	87.9	8.89	8.89
AIRTEL Rwanda Ltd	72.60	72.60	6.29	6.29
Population coverage				
MTN Rwanda Ltd	99.90	99.90	71.14	71.14
TIGO Rwanda Ltd	99.53	99.53	46.53	46.53
AIRTEL Rwanda Ltd	90.30	90.30	12.40	12.40

Table 2: SMS Traffic per Operator in June 2014. Source: www.rura.gov.rw.

	MTN Rwanda LTD	TIGO Rwanda LTD
OUTGOING TRAFFIC		
On Net	103,852,033	216,804,183
Off Net	2,255,813	2,088,919
International	583,577	540,721
INCOMING TRAFFIC		
Offnet	2,640,233	1,994,280
International	9,605,871	252,400

From the above tables we see that the major players in mobile telephony and main SMS service providers are MTN Rwanda cell, TIGO Rwanda Ltd and AIRTEL Rwanda Ltd [2].

2. Literature Review

2.1 Related works

The Short Message Service (SMS) is increasingly incorporated into organizational information systems for marketing, communication among staff to clients and the general public; as well as for on-demand information services [3]. Inside education sector, the implementation of SMS technology to address students' requests for the provisions of administrative communications have been thought out [4, 5]. The Short Message Service (SMS) is used for administrative support, for example, to communicate alerts on semester closure to parents and exam results to students [4, 6]. Information systems to meet communication service requirements within distance learning programmes have been developed [7-10], and the student examination results checking system at university is reported by authors in [11]. Eventually, several higher learning institutions are evaluating the technology infrastructure development and awareness of university community members [12, 13] towards SMS based communication solutions. At the University of Rwanda - College of Education, a preliminary investigation on Distance Training Programme students and managers' perceptions toward SMS in support of offline learning, and a conceptual design of mobile SMS communication system to support the DTP programme administrative communications are reported by authors in [1, 7]. Different service type of SMS applications can be applied to implement the semester examination results checking at UR-CE:

- ✓ **An out-bound service:** allows an application to send text messages to one or more known mobile phones. With the assistance of an SMS service provider, who provides the channel between the application and the mobile phone network, this service is simple to establish. Typically, the application program issues an HTTP GET request, with the number, message and other details encoded in the URL [14]. The service provider then hands this off into the GSM network for delivery. Delivery notification can be returned to the application via a call-back URL. An out-bound service is good for SMS PUSH to subscribers.
- ✓ **A 2-way SMS:** allows a user with a mobile phone to send a text message that is received by an application, which can then reply with a message back to the originator [14]. A 2-way SMS service requires a GSM number, to which users can text a message. The message is routed through the service provider to the nominated user's application script, again using HTTP. The application will then perform some tasks such as a database look up and then may text back a response to the originator.

Similar works to allow students to check their marks via Internet or SMS have been implemented. The authors in [15] review the use of mobile phones for delivering examination results via Short Messaging Service (SMS) in a university, where students who have written examinations and are anxious to see their results need to get their grades in a convenient and accessible way. They show the implementation of such a system and consider the security issues associated with it.

2.2 Problem statement

This work considers communication channels used within the Distance Training Programme at College of Education, University of Rwanda. The authors in [1] identified the communication channels used to support DTP communication delivery at UR-CE, and the related strengths and weaknesses. Of interest here is that the DTP students are accessing their semester examination results through a single notice board located at the UR-CE main campus. The notice board has its own advantages such as:

- ✓ The notice board published examination results can last-long and can be accessed at any time;
- ✓ The notice board published examination results are officially signed/stamped (genuine);

- ✓ A student can request a third person about his/her published results, etc.
- Limitations associated with notice board published examination results include but not limited to:
- ✓ The DTP students do not have a frequent access to the notice board considering their geographical (village) locations across the country;
 - ✓ It requires DTP students to travel to UR-CE main campus to check the examination results; thus introducing travelling cost, time consuming, and other related supplementary cost such as restaurant as well as when it requires to spend the nighttime;
 - ✓ Some students; with immoral behavior; can take out the published printout of examination results most likely to being embarrassed by their exam failure, or willing to help bring the results to their very-close classmate(s) or motivated to keep their examination records. Thus, preventing other fellow classmates access to results or forcing them to go personally to CODEL office to request for exam results checking;

Meanwhile, DTP students call their fellow day program students in order to ask about published examination results as alternative to travelling to UR-CE main campus where the results are published [1]. It is unnecessary money spending and disclosing their academic privacy. There is no rationale to DTP administrators and students to remain focused on notice board published examination results while it is known DTP students at UR-CE do not have frequent access to notice boards [1]. There is therefore, a need to devise an alternative SMS based solution to help DTP students to personally access examination results, and that is strengthening the DTP administration communications success.

3. Materials and Methods

3.1 Methodology

Methods used were questionnaires and interviews with DTP students and DTP management staff. The DTP students were invited to participate in the survey during face to face sessions dated from April 16th to April 26th, 2014. The survey included a sample size of 294 DTP students from the total population size of 1092 students. The sample size was calculated based on the formula provided by Yamane (1967) according to the following law as cited by [1, 16]:

$$N = \frac{NP}{1 + (NP * e^2)} \dots\dots\dots (1)$$

Where:

N: Sample size,

NP: Is the size of population,

e: Is the level of precision errors= 0.05,

The interviews were addressed to the Director of Centre for Open, Distance and e-Learning (CODEL), Dean of Faculty of Education, Dean of Faculty of Science and Dean of Art and Languages. The choice of these offices was made based on their involvement in the DTP programme as administration management office for CODEL and Academic management for Deans' Offices; as DTP students are taking subject materials from these three faculties under the CODEL administration, coordination and management [1]. Different frequency tables were prepared to illustrate the views of participants in relation to each question towards the use of SMS communication in DTP at UR-CE. A similar method was applied by [5, 16, 17]. The literature review and the Unified Modelling Language (UML) [3, 18, 19] was used to come up with a deployment physical architecture view of student examination results access (SERA) system via mobile SMS [20] to make the SERA transactions be as personal as a natural conversation, albeit in texting.

3.2 Requirements analysis

Requirements analysis was conducted after surveying/interviewing in addition to onsite visits to understand specifically what is required to enable UR-CE students access their examination results via mobile SMS [15, 16, 21] self-service as an alternative access channel to notice board. The study established what the DTP students wish to receive through SMS on their mobile phones, and whether the environment is conducive to tackle the communication barriers. The majority of respondents surveyed indicated the need to alert DTP students on the availability of examination results, among other communication needs. Table 3 illustrates the key types of information DTP students would like to receive from UR-CE through SMS technology.

Table 3: The need for mobile SMS messages alerting mechanism.

Need to receive SMS messages:	Frequency	Percentages
Access the semester examination results	218	89.3%
Alert on publication of examination results	199	81.6%
Alert on the coming Face to Face	190	77.9%
Alert on the assignment due date	183	75.0%
Academic calendar	180	73.8%
Sending request to DTP staff	158	64.8%
Alert on next weekend tutorials	154	63.1%
Information related to time table	141	57.8%
N=244		

3.3 UR-CE current IMS overview toward examination

The information management system (IMS) used at UR-CE provides services to students such as online application for admission, online registration, online approval of education cost payment, and the chart/forum discussion. These facilities are mostly used before the commencement of each academic year. It requires students to have access to the Internet to benefit from the UR-CE's IMS services. Unfortunately, the students are not provided with access to the examination results through IMS. The UR-CE's IMS admits that the processing of semester examination results is primarily done for academic transcripts production. Thus, examination results are processed from departmental level, then at faculty level and officially approved by the academic senate meeting, and finally published on the notice board for student's awareness. The examination results are then sent to academic registrar's office as MS Excel format to be uploaded into the UR-CE IMS for safe keeping. After this, the results await for the student's academic transcripts processing stage.

3.4 SMS Service provider connectivity

In SMS messaging, an SMS service provider is an entity responsible for sending and delivering SMS messages from users/applications of the program to recipient mobile phones, and responsible for sending SMS messages from mobile phones to SMS server, which will deliver them to users/applications of the program [22]. To send and receive SMS messages using message server, there is a need to pay one or more GSM service providers for the service and the connection of SMS server to the SMS Centre of one or more service providers. This can be achieved in two ways [11]:

- ✓ **Independent Service:** It does not require authorization of the service provider or connection to any third party SMS provider. It connects to the SMS Center using a GSM modem attached to the office computer (PC) with a phone-to-PC data cable or on a USB port. In this case, a user buys a SIM card from the service provider and the normal SMS charges apply [11].
- ✓ **Dependent Service:** This involves having the application server connected to the service provider SMS Center (SMSC) over the Internet. Thus, it needs a service contract with the service provider. In compensation for subscription, the GSM service provider may provide the client-user with the information required for connecting to the SMS Center over the Internet such as hostname, port number, username, and password. It requires a constant connection to the Internet as the application server does not require any physical phone/modem with a SIM card connected to it. When users send their requests, they go to the SMSC, which automatically forwards the messages to the application server over the Internet [11].

Dependent service provides extra benefits as the service provider can provide a special tariff and a dedicated line for the client-user (UR-CE in our case). The SMS application runs on corporate servers that are connected to the SMS network through specialized connectors and gateways connected to the SMS Centre (SMSC) of mobile operators. These servers are assigned short numbers instead of the traditional 10- or 12-digits mobile number. These numbers, also known as short codes are usually 3 to 4 digits long and are operator specific in Rwanda [23]. Also, a premium fee (a fee other than the fixed rates for SMS) can be charged on these short codes. In other words, users would pay more for sending SMS to short codes [23]. Direct connection to the SMS Centre by setting up an IP SMS account with one or more GSM service providers has several advantages, including a greater speed and reliability with the following steps:

- Step1:** User sends request to SMS gateway;
- Step2:** SMS gateway forwards request to application server;
- Step3:** Application server processes request and responds to SMS gateway;
- Step4:** SMS gateway forwards reply to user's mobile number;

There are two methods of SMS widely used in this kind of applications: "PUSH & PULL". The semester examination results access (SERA) checking by DTP students can either take place by pushing SMS to students;

thus providing the semester examination results as soon as they become available; or by students pulling SMS from the application (working on a request sent from a student to access examination results). By PUSH method, students do not request for the results, do not take any action and are not charged for receiving the SMS contrary to Pull SMS application whereby a student sends a request and obtains a reply from the application and the SMS charges may apply.

3.5 Cost benefit review

The service providers in Rwanda have reduced tariffs and introduced service promotion plans such as ‘per second’, VUGA Pack, MTN Supa Packs, SMS packs to allow subscribers to enjoy telecommunication services. From the preliminary analysis, 219 (89.8%) out of 244 DTP students who participated in the survey affirmed to be ready to accept SMS charges. Thus, implementation of SERA potentially will save time and money that is currently spent to travel to UR-CE main campus to check the examination results or calling a third person. As shown in Table 4, out of 244 students asked about their preference service provider, the DTP students’ SMS carrier provider preference is MTN-Rwanda Ltd with 129 (53%) and TIGO-Rwanda Ltd with 105 (43%). Their preference does not remove the fact that some students may subscribe to both companies.

Table 4: Preferred SMS carrier provider.

Preferred Telecom. Company	Frequency	Percentages
MTN-Rwanda	129	52.9%
TIGO-Rwanda	105	43.0%
AirTel-Rwanda	10	4.1%
Acceptance of the payment of SMS charges	N=244	
Yes	219	89.8%
No	25	10.2%
	N=244	

If privacy of SMS service is to be considered, then the SERA should be implemented with protection of student’s details by using password to the designated phone number. Students can include specific details like the level (year) and semester number for which results to be checked are requested [15].

4. SERA Physical Diagram Structure

The available telecommunication infrastructures and technologies serve as a basis to figure out alternative solutions to notice boards for semester examination results to UR-CE students with the use of mobile SMS service [2, 22, 24]. The SERA application queries the database and filters out the DTP student’s examination results appropriately after which it sends the examination result back through the GSM terminal as shown in Figs.1 and 2.

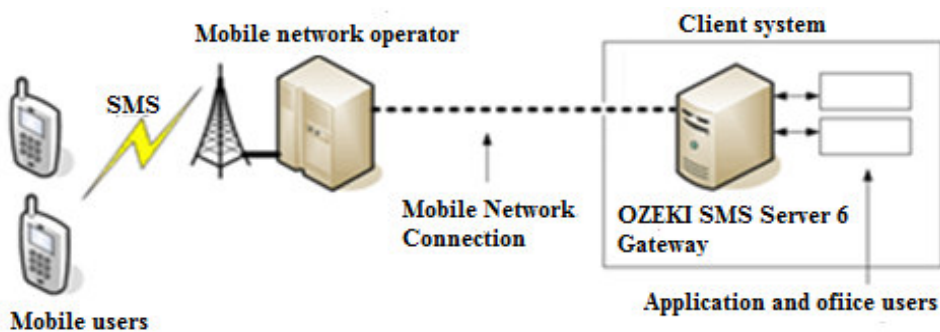


Figure 1: SMS results checking physical deployment structure. source: [24].

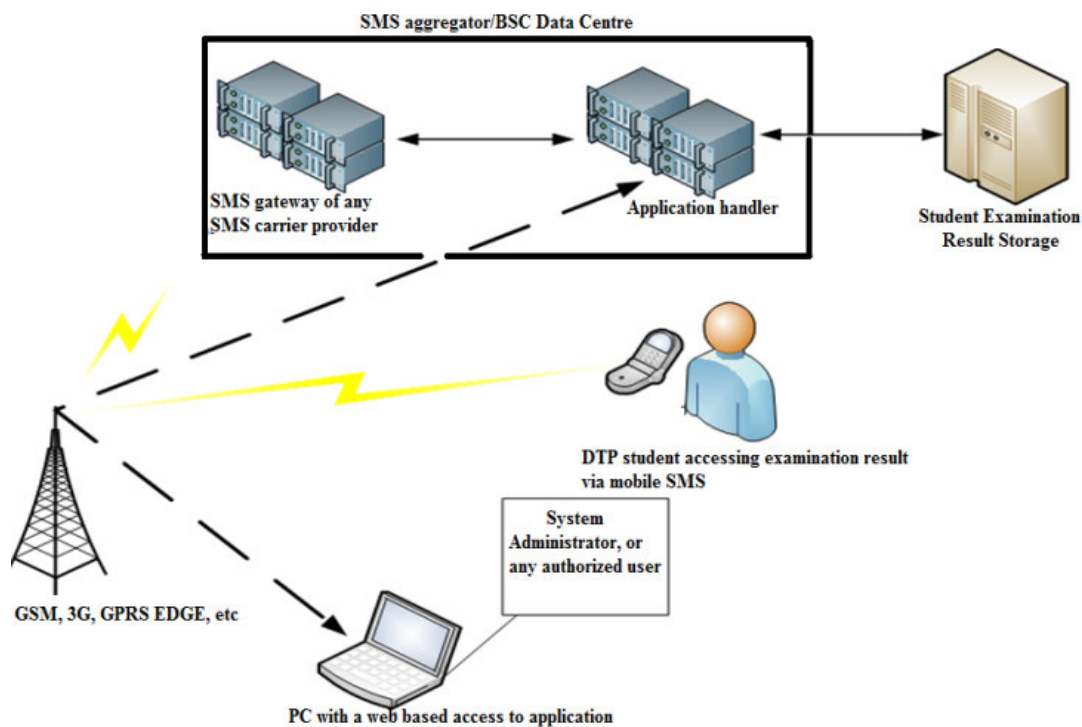


Figure 2: SMS results checking physical deployment structure. source: [25].

The SMS server receives SMS messages from the users and processes them by connecting to the database that holds the personal details and examination results. In this case, students are required to send SMSes from their mobile phones to a particular number; standard phone number or short code number; provided by the SMS service provider and request for examination results. In both cases, the student will send the keyword to the assigned number and in turn the keyword along with the mobile number will be routed to SMS gateway server. The processed results (SMS message) are sent back to the student's mobile phone number at the same moment. The student will be charged the cost for the short code message which can be different from the normal SMS cost depending on agreement among the institutions participating in the SMS communication [23]. At this stage we are testing the suggested prototype with a GSM modem connected and configured to the OZEKI NG SMS Server version 6 as in Fig.1. Ozeki Message Server 6 is a powerful, flexible SMS Gateway application, which enables users and their applications to send/receive SMS messages to mobile devices with their computer. Application itself can be written in any server-side language. At present we use PHP version: 3.5.2.2, (PHP originally stood for Personal Home Page, it now stands for Hypertext Pre-processor) for ease of interfacing with a web server (Apache/2.4.3 (Win32)) and database server support (Server: 127.0.0.1 via TCP/IP; Database software version: 5.5.27 - MySQL Community Server (GPL)). Once tested and approved for implementation, the application can be linked to the SMS service provider and the new service becomes immediately available from any mobile phone.

The Semester Examination Results Access (SERA) at UR-CE can be overwhelmed by limitations of SMS as identified in [15, 26, 27]:

- ✓ Unlike published paper results on a notice board which are stamped, it is difficult to certify SMS results. However, mobile operators provide numbers that bear a name of company or institution. This way a user can be sure that the message originated from the right source in case the SMS PUSH method is used;
- ✓ As an SMS protocol rule, the length of an SMS message is 160 characters. This is a limitation in SMS technology. Therefore, the messages are abbreviated depending on the availability of the space; therefore, they may look different from the one on notice board;
- ✓ The SMS technology does not guarantee set transmission times or guaranteed delivery of the message. Thus, SMS messages may be delayed, blocked or lost in transmission; making a barrier on SMS push method;
- ✓ The cost of the message might be transferred to the sender. It is also possible to refund such cost, and to operate volume based tariffs. Here most DTP students who participated in the needs assessments survey showed keenness to pay the SMS cost for mobile SMS communication service in support of Distance Training Programme (DTP);

5. Discussion and Conclusion

The paper has focused on the situation analysis and requirements gathering to allow DTP students at UR-CE access semester examination results through mobile SMS. The prompting scenario is the release of marks made available at one and only one place; i.e: main campus notice board which disregards the scattered geographical locations of intended audience. Thus, the DTP students are required to travel from all corners of the country for examination results checking. The process is likely to cause unnecessary money spending, time consuming and unnecessary supplementary risks that go with travelling.

Considering the DTP students need to access communication services through mobile SMS, in addition to good coverage of telecommunication services in the country [2], we advise the UR-CE management to contact SMS service providers for partnership to implement SERA via SMS technology. Meanwhile, there is an information system already in place which is used to keep the results for further academic transcript processing that can be linked to SMS service provider to shorten the implementation of SERA. Thus, the success of SERA depends on implementation policy and UR-CE management willingness.

The following recommendations are in line with the above findings:

- ✓ In order for UR-CE to set up the mobile SMS in support of DTP programme communications, efforts to establish public-private partnerships should be pursued with SMS service providers.
- ✓ The DTP managers should lobby the university administration to come up with a definite policy for mobile SMS in support of DTP programme. A step-by-step process has to be followed in implementing it, and staff and students have to be made fully aware of implementation developments. Lack of everyone commitment is likely to make the programme fail as it was at the Department of Distance Education at Makerere University [27].

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