

Designing a Mobile SMS System to Support Offline Distance Training Programme Communications at University of Rwanda

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Abstract

This paper reports on a study carried out to establish the basis of designing an Offline Distance Training Programme Mobile Short Message Service Communication System (ODTPmSMSCS) intended to improve administrative communication within the Distance Training Programme (DTP) at University of Rwanda-College of Education (UR-CE). The paper outlines the ODTPmSMSCS structure, potential users and the associated implementation challenges such as lack of a policy for SMS to be among the official communication channels of the DTP. In addition to the implemented prototype, the paper presents some recommendations to be considered for implementation by the UR-CE managers to assure that users are committed to use and allow for sustainability of ODTPmSMSCS to take advantage of the technologies the DTP students already have.

Keywords: DTP students, Distance Training Programme, UR-CE, University of Rwanda.

1. Introduction

Mobile phone short text message communication is a modern telecommunication aspect of Information Communication Technologies (ICT) that is systematically revolutionizing human communication the world over [1]. The high access to mobile phones by distance learning students opens up the opportunity of higher learning institutions communications to reach students anytime and anywhere. The DTP at UR-CE started in 2001, with ten learning centres grouped into four regional administration centres and these run under a single administration unit [2]: The Directorate of Centre for Open, Distance and e-Learning (CODEL). The DTP meets the characteristics of distance learning as the ones cited in [3]:

- ✓ The learner is physically separated from the teacher;
- ✓ Monthly weekend tutorials are organized at ten different learning centres;
- ✓ Learning is individualized; distance education requires an independent self-learning style for the student;
- ✓ Learning packages make use of printed materials;
- ✓ Two-way communication among DTP staff and students exists through printed communications, electronic mails distribution, and telephone calls;

Communication technologies are increasingly becoming a key aspect of distance education since they are used for administrative communication, as a facility for two-way communication between lecturer and students, between tutor and students, and as an aid for teaching and learning [3]. Notable is that available communication channels to support DTP at UR-CE include printed notices, e-mail distribution and radio broadcasting [2]. However, these channels cannot address message urgency [4], and alerts are often handled in an ad-hoc manner. To improve and monitor the quality of communications among DTP students, DTP subject tutors, and DTP administrative staff, we propose, in this paper, a communications management infrastructure based on an alert mechanism. Alerts and reminders have to be delivered and handled on time to provide ubiquitous DTP communication support and management.

2. Literature Review

Rwanda has three mobile service providers: Mobile Telephone Network (MTN-Rwanda Limited), TIGO-Rwanda Limited and Aitel-Rwanda Limited. These providers have reduced tariffs and introduced service promotion plans such as per second, VUGA Pack, low cost Internet bundle, and SMS packs to allow subscribers to enjoy telecommunication services [5]. SMS is raising the importance of instantaneous communication, reaching every mobile user at affordable cost. Bulk SMS system has expanded that capability of SMS by implementing the ability to easily send SMS messages to multiple intended recipients. Responsibly, higher learning institutions have endorsed the potential to communicate to institutions' community by implementing bulk SMS [6]:

- ✓ *TriggerThat* was a prototype tested at the Australian Technology University (ATU)[7], to communicate administrative details, such as assessment and teaching schedules to students using SMS. Staff can remind students about assessments and alert them to useful topical events available using other technologies for download. Staff recorded messages to be sent weekly in an Excel template [6]. Messages were classified as: (1) Reminder on assignment and test due dates, (2) Alerts on Extra

material added to the Distance Learning System, multimedia, iPod downloads and special events, (3) Assessment marks, and (4) Class changes.

- ✓ The B-SWU system, Srinakharinwirot University's dynamic bulk SMS was implemented to enhance the school's educational communication [8]. It allows students to access academic information such as admission announcement, university's news and events, enrollment information, internship opportunity and grade results, from the university's e-service systems and distributes it to registered users.
- ✓ Chikka6: a PC-to-mobile system is truly Philippine-made as it was developed and run by Filipinos. It is used by the University of Philippine to communicate to students [3].
- ✓ The DDE BROADCAST SYSTEM: This innovative internet-based software program was implemented in the Department of Distance Education at Makerere University, Republic of Uganda. The program had capacity to send instant SMS messages to the mobile phones of students and to the email addresses they provide. It failed because of poor management decision, lack of staff interest to use it, etc [9].

SMS is categorized into two categories: peer-to-peer messaging category and value-added services category. In peer-to-peer messaging, SMS transmission originates from a mobile phone to another. The transition process is handled by SMSC. On the other hand in value-added services, SMS transmission occurs between mobile phone and application as in Fig. 1. The value-added services are handled by SMS gateway to operators and service providers. Bulk SMS is an example of a value-added service category of SMS. Bulk SMS offers a better solution to distribute information instantly to multiple cellular users without using complex computer devices [8].

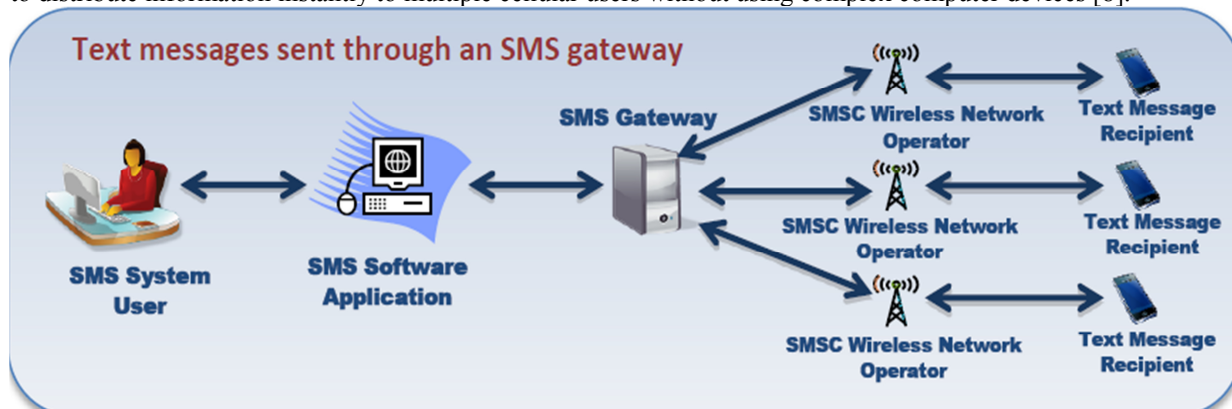


Figure 1: Text Message Sent through an SMS gateway. (Source: [10]).

The authors in [1] identify positive (Pros) and negative (Cons) aspects of Short Message Service. The Pros include that SMS saves time, reduces cost, aids articulate feedback, ensures convenient response, serves as legal evidence, encourages bold reply, represents a more health-friendly medium and guarantees confidentiality. The Cons include that SMS can aid crime, be used to defraud, be vague/ambiguous because of its abbreviated language, be delivered late when events have overtaken message sent, be reduced in length and rendered incomplete when message is lengthy, be used to perpetrate examination malpractices and be responded to late when the receiver has a busy or tight schedule.

3. Problem Statement

Based on the foregoing literature review, SMS technology is thought out to improve communication between DTP students and DTP staff in an inclusive manner and assures that DTP students do not miss out on important activities or even left to feel isolated [6]. However, there is the problem of lack of timely communication update to DTP students [2, 6]. A change of timetable for face-to-face sessions might disturb DTP students when the update does not reach them on time. Sometimes students take a journey to attend the session while it is already postponed or cancelled. It happens to some DTP students to submit the assignments late because of lack of communication reminder. The unplanned money spending on phone calls, travel cost on the side of students, being late to act in reply to assignment due date, examination results claim, and the annoyance because of change of timetable for face-to-face sessions might disturb some DTP students. Reaching DTP students physically is difficult. Therefore, on time communication is needed to empower them access the information and save the cost of travel to the main campus, learning centres or cybercafé if e-mail communication is used. From this reality of SMS communication in distance education, there is no rationale to DTP administrators and students to remain focused on printed and e-mail communications while it is known DTP students at UR-CE do not have frequent access to notice boards and to the Internet [2].

4. Methodology

Motivated by the general lack of a timely communication channel in the Distance Training Programme at UR-CE, a study was proposed to design a computer based mobile SMS communication system to support the DTP.

By gathering the requirements from DTP administrators and DTP students, we came up with a cost effective, simple, and user friendly bulk SMS to improve and manage ubiquitous communication for the DTP. Requirements analysis was conducted to understand precisely what is required of the prototype and the detailed requirements were elicited and formulated into an alert/reminder conceptual model [11]. Then we sketched an overall system architecture for the Offline Distance Training Programme Mobile SMS Communication System (ODTPmSMSCS). The Unified Modeling Language (UML) [12-14] was used to design the prototype architecture in user case diagram, Context level Data Flow Diagram, Sequence and Diagram. Coding of the front end application was done by using PHP programming language, HTML tags, Java Script, and CSS. The back end application is running on Ozeki Message Server while the database management system is MySQL database server. A GSM modem connected to a laptop served as the connection between the proposed system and SMS carrier providers [15].

5. Results and Discussion

5.1 Existing communication overview through SMS

There are several SMS communications among DTP students and DTP subject tutors, regional coordinators, DTP students and their fellow day programme students, and among DTP students themselves at UR-CE [2]. The SMS is a tool for communication between the DTP students and the CODEL officials including faculties' Deans as it was reported during interviews held with the Director of CODEL and Dean of faculty of Science at UR-CE. This use of SMS by DTP students support their need to benefit from a direct college communication. The study [6] support this need of a university direct conversion such as reminders to complete teacher directed activities to make students feel not isolated from the university community. Sharing information on semester examination results is one among the major causes driving DTP students to exchange SMS with their fellow classmates or their fellow day programme students. Thus, implementing ODTPmSMSCS for alerts and reminders has the potential to enhance and improve the DTP administrations communications to students [8]. Although SMS communication is used in DTP communications, it is not recognized as an official communication channel for the DTP programme. According to the Director of CODEL, the recommended communication structure is done by passing all communiqués through the CODEL office, then forwarding the same to regional centre coordinator, before it reaches the DTP students either by printed notice board, or via e-mail distribution [2]. All communications from faculty to DTP students; and vice versa; follow this structure as reported during interviews held with the Dean of faculty of science and Dean of faculty of Education. The desire to integrate SMS into DTP official communication channels is positively thought-out by the Director of CODEL, Dean of faculty of Science and the Dean of faculty of Education at UR-CE. The SMS solution is right in line with the UR-CE vision of ICT use in education. SMS may now be advocated and promoted as a communication tool to provide reminders; alerts to support distance training programme communications.

5.2 Identified users of proposed system

The users of the proposed system are identified based on their involvement, responsibility, and the inter-activities with DTP students:

- ✓ **The DTP administration staffs** at the UR-CE main campus (CODEL staff) are to be granted permission to send SMS to the entire DTP students' community as a single group of message recipients, to level of study (year of study) as a single group, to DTP students by subject combination orientated, to students by regional centres. The content of a message can include and not limited to alerts to collect study material corresponding to subject modules, change of weekend tutorial calendar, arranged timetable for face to face sessions, internship supervision period, release of semester examination results, and reminder to clear financial issues, etc. The CODEL staffs are entitled to access incoming messages from students.
- ✓ **The regional coordinators** are to be permitted to send SMS to all DTP students under the coordination entitled to; and being grouped by their learning centre, level of study or their orientation combinations. The message can include change in timetable, reminder of assignment due date, availability of study material subject module, etc.
- ✓ **DTP Subject tutors** are entitled to provide tuition of the study material based on combinations, thus granting them to communicate to the DTP students taking the tutorials. These shall include alerting the DTP students on the study block to rework/practice for the upcoming weekend tutorials, or reminder for assignment submission due date.
- ✓ **The DTP students** are identified to be potential users and beneficiaries of the proposed system. Thus the subscription for receiving SMS is a requirement for them. The subscription activity is via web interface, and a student is allowed to subscribe with one GSM SIM card to avoid unnecessary cost of duplicated message to a student. In addition to receive SMS messages, DTP students are able to send SMS messages to the proposed system in line of communication feedback. The DTP students might also be allowed access to semester examination results.

- ✓ **System Administrator** is entitled to add users and assigns permissions to them. To download incoming messages and to handle helpdesk issues.
- ✓ **UR-CE IMS** (the current information management system at UR-CE) should integrate the proposed system to allow students access to semester examination results.

Indeed students would find subscription to ODTPmSMSCS beneficial, in terms of saving time and money. The mobile phone text messages save communicators from those airtime consuming factors or situations and equally save some money altogether. Alleviation of annoyance by enjoying SMS self-service checking the semester examination results is another way how SMS saves time, reduces cost, aids articulate feedback, and guarantees confidentiality [1].

5.3 User case diagram

In information system modeling, the important aspect is to capture the dynamic behavior of the system when it is running /operating [16]. Internal or external factors that cause the interaction are known as actors. Thus use case diagram consist of actors, use cases and their relationships. Use case diagrams are used to gather the requirements of a system including internal and external influences. When a system is analyzed to gather its functionalities user case are prepared and actors are identified [14]. The purpose of system requirements analysis is to get a thorough and detailed understanding of the business need as defined in project initiation and captured in the business case. Generally, requirement analysis always classified as functional requirements and non functional requirements. The Architectural design of the ODTPmSMSCS is based on four tiers architecture as proposed in [17]. This architecture for mobile applications offers more abstraction, more independence between components of the system, and hence a more flexible way of implementing mobile applications. Figure 2 illustrates the user case prepared for the ODTPmSMSCS with the following requirements:

Functional requirements:

- ✓ It mainly emphasizes creation and implementation of a Computer based mobile SMS system;
- ✓ It should automate the system with the help of SMS that informs the DTP student user about the availability of released examination results;
- ✓ It will relieve and speed up the communication notice updates to DTP students of UR-CE;
- ✓ It should be able to synchronize DTP student data with a current information system at UR-CE;
- ✓ Documentation requirements: user guide and training manuals of the system to be provided to assist users on working with the system. The system documentation will assist technical personnel to maintain the system;

Non-functional requirements:

- ✓ Professional look and feel;
- ✓ Browser testing and support for Internet Explorer, chrome, Mozilla & Firefox, etc;
- ✓ Reliability requirement: system can be replicated;
- ✓ Execution qualities like such as testability, maintainability and scalability;

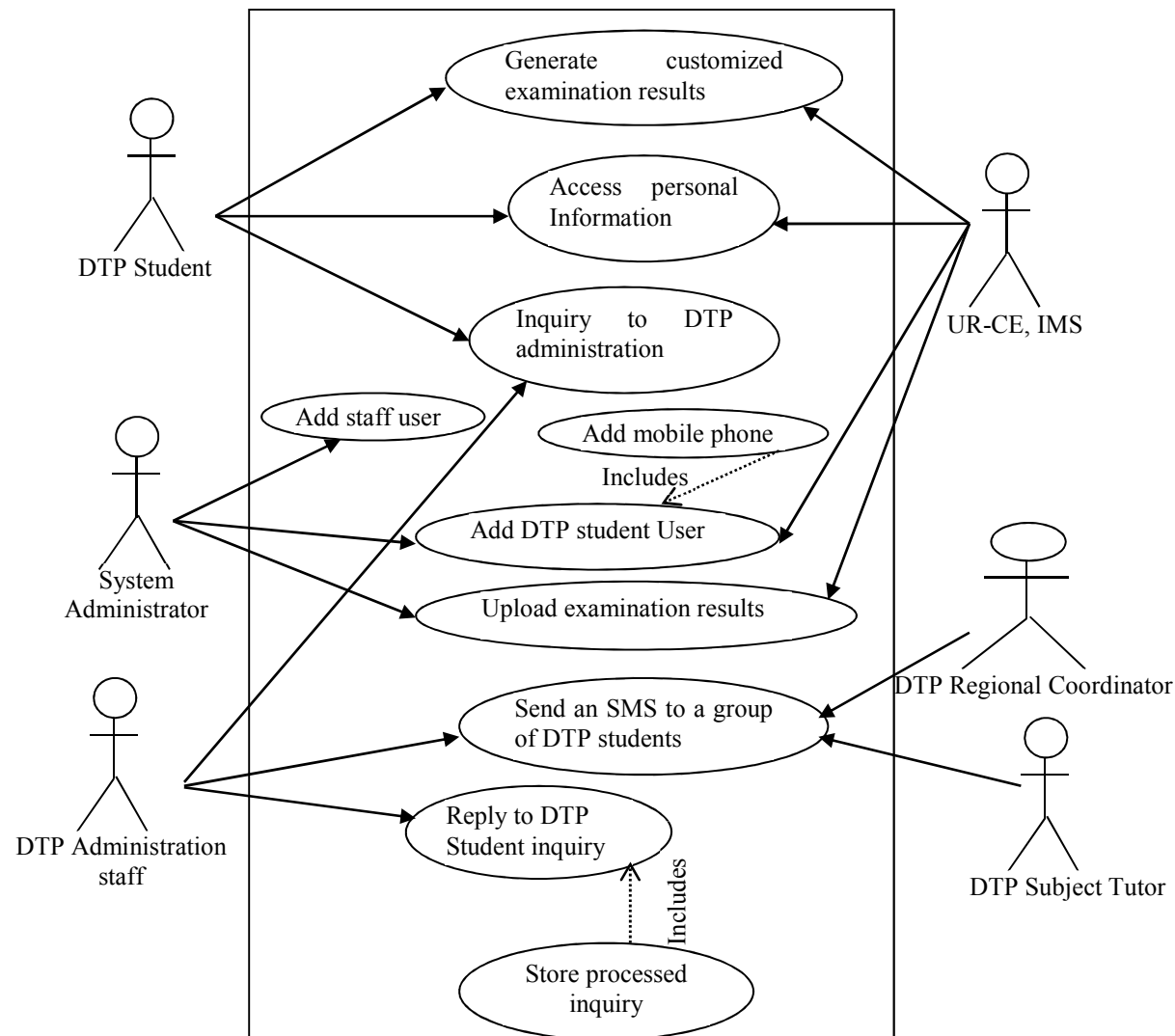


Figure 2: User case diagram of ODTPmSMSC System.

5.4 Context diagram

A context diagram is a data flow diagram that provides the general abridgment of the system indicating the major data flows between the external entities and the system. The context diagram provides the system's boundaries by highlighting its sources and destinations. The main process is the Offline Distance Programme mobile SMS communication system (ODTPmSMSCS). The five entities namely DTP student, CODEL Staff, Regional coordinator, DTP student, and UR-CE IMS are external to the system with data flows in and/or out of the ODTP-mSMSCS.

Table 1: Context Level DFD Description.

Process	Description	Entities
ODTP-mSMSCS	The system will manage DTP SMS communications. The major activities involved include to keeping track of SMS messages sent to and/or coming from DTP students,	DTP student, CODEL CODEL staff, DTP student , DTP Regional coordinator, UR-CE IMS,

The context DFD corresponding to the ODTPmSMSCS process with the external entities and major data flows is illustrated in Fig.3.

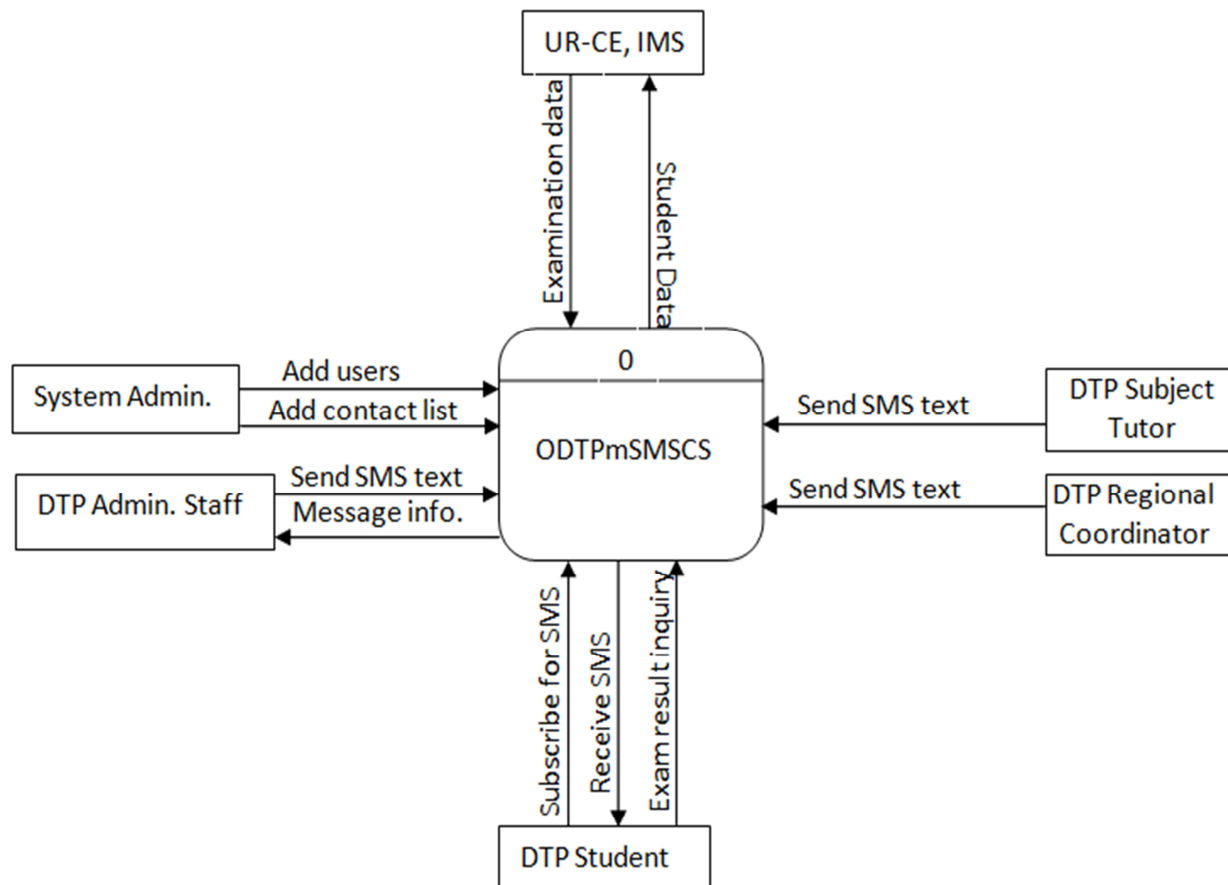


Figure 3: ODTPmSMSCS context level DFD description.

5.5 Sequence diagram

A sequence diagram is an interaction diagram. From the name it is clear that the diagram deals with some sequences, which are the sequence of messages flowing from one object to another. Interaction among the components of a system is very important from implementation and execution perspective. So Sequence diagram is used to visualize the sequence of calls in a system to perform a specific functionality [13, 14].

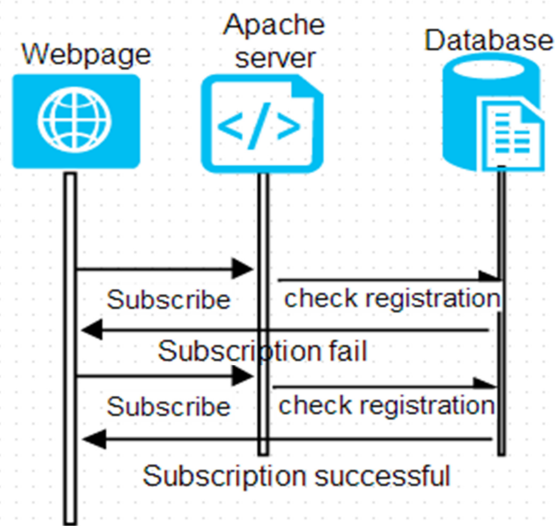


Figure 4: DTP students' subscription sequence diagram.

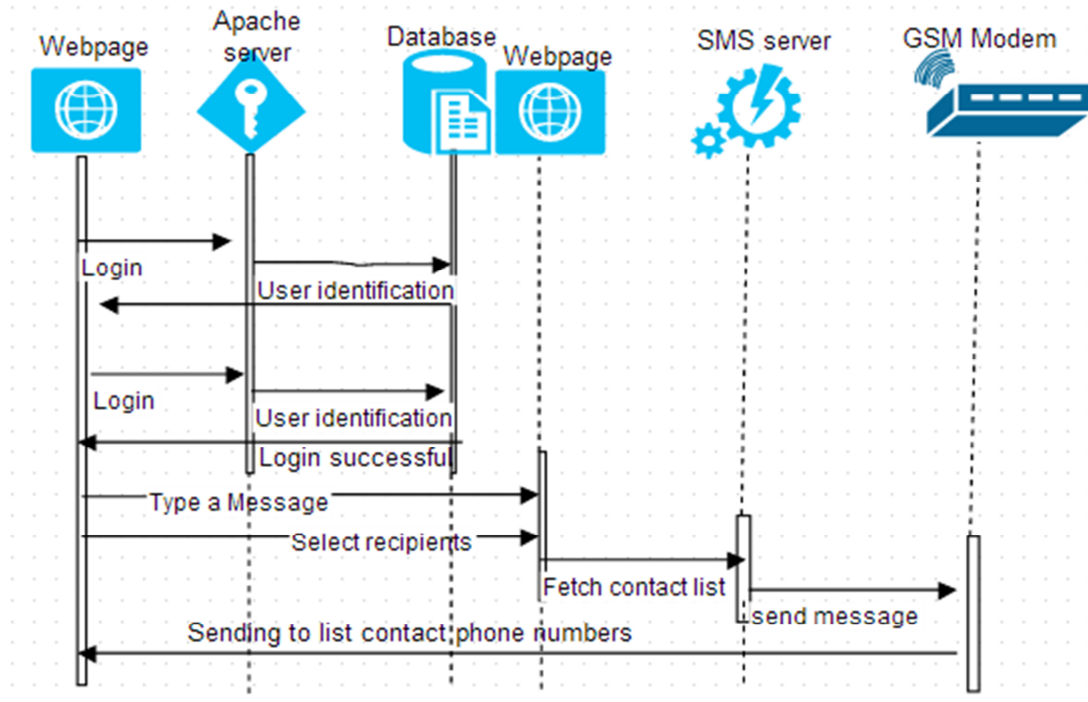


Figure 5: Sequence diagram of user sending an SMS.

5.5 Prototype white box testing requirements

We assume the CODEL staff is sending a Message to a certain DTP students group. Figures 6 and 7 illustrate steps while Fig.8 represents one among designed interfaces. One scenario ODTPmSMSCS white box [18] testing is illustrated here following seven steps:

Start.

- Step 1: The user login.
- Step 2: The ODTPmSMSCS compares the login data to data from user table to allow or deny access.
If deny, return to Step1, else go to Step3.
- Step 3: Type the message to be sent.
- Step 4: Select the recipient group of DTP students.
- Step 5: The apache server fetch phone numbers contact list coupled to the selected recipients group.
- Step 6: SMS server load the message content, and
- Step 7: Message is sent to SMS carrier provider provided the GSM Modem is attached and configured.

End.

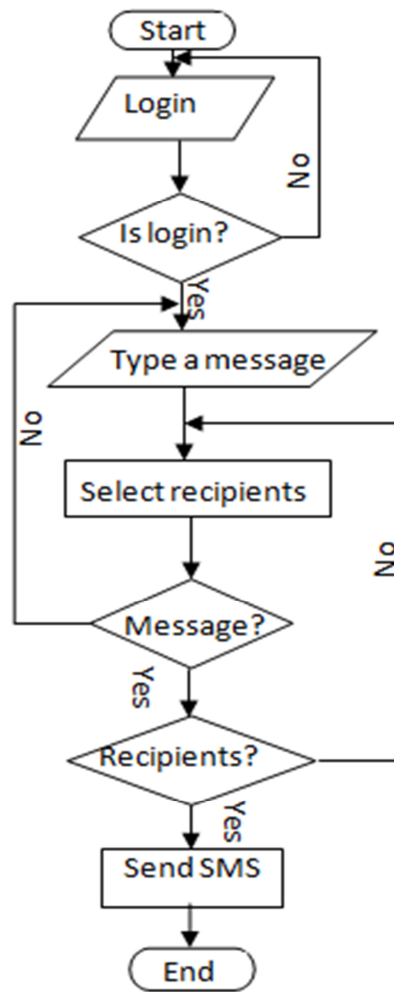


Figure 6: Statement testing.

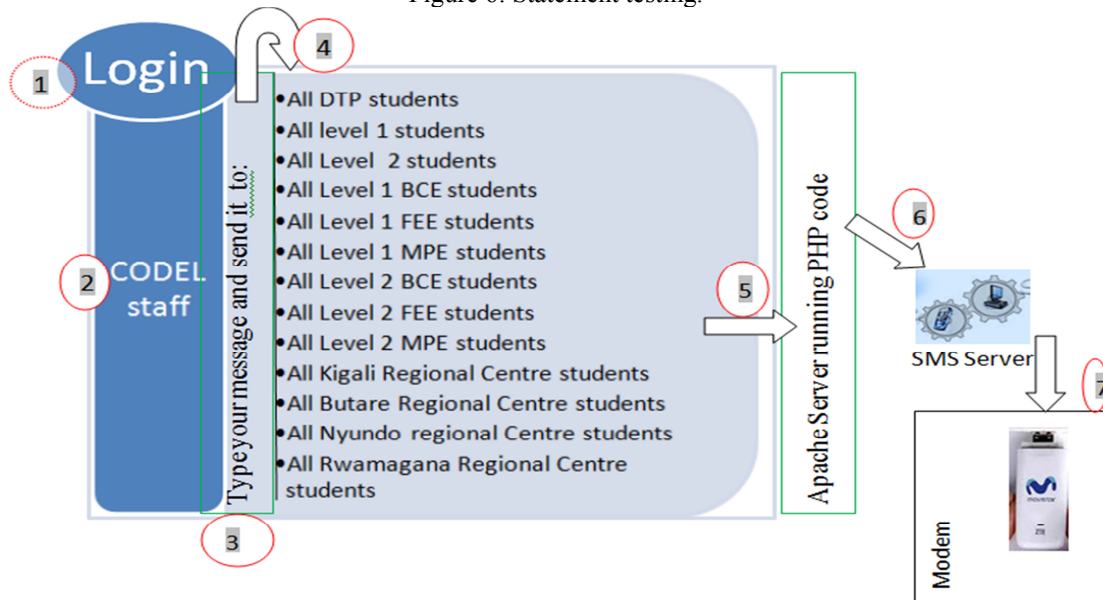


Figure 7: Message sending process.

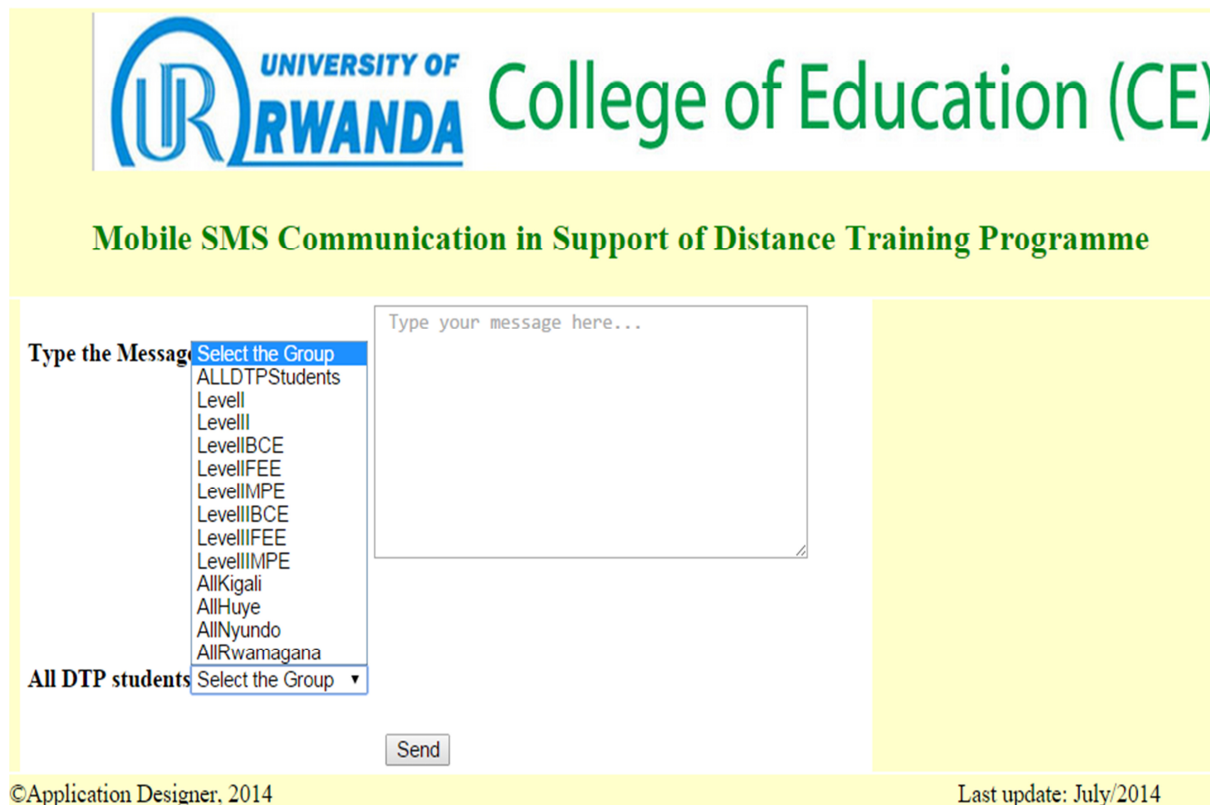


Figure 8: SMS sending web interface.

6. Conclusion

To improve and monitor the quality of administration communications among DTP students, DTP subject tutors, and DTP administrative staff, we propose a management infrastructure based on an alert mechanism. Alerts and reminders have to be delivered and handled on time to provide ubiquitous distance education communication support and management. The proposed ODTPmSMSCS can be applied not only to communicate to the DTP students, but also to communicate to other students and staff. The ODTPmSMSCS users are located at different learning centres according to their employment contracts with UR-CE. Thus, web based interfaces are implemented to allow users (DTP administration staff and Subject Tutors, Regional Coordinators) to access the system whenever the need to communicate to DTP students arise. The pros listed in [1] are motivational factors to recommend implementation of ODTPmSMSCS. The cons and challenges [1, 9] are to be considered to guide a proper use of ODTPmSMSCS at UR-CE. The SMS message is 160 characters long, thus users are to be introduced on common abbreviation to limit the length barrier of SMS. The ODTPmSMSCS is to provide DTP with a timely communication. Through a policy, each user has to use it for only academic purposes. Further efforts to establish public-private partnerships should be pursued with SMS carrier providers (SMS aggregator) to allow the sending of multiple bulk SMS at a reasonable cost. The UR-CE administration should define a policy for SMS communication in DTP. A step-by-step process has to be followed in implementing it, and staff and students have to be made fully aware of its implementation. Further work is recommended to design a semester examination results access module to allow DTP students check their examination results via mobile phones.

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