SMS-Based Event Notification System

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Abstract

Existing mass Short Message Service (SMS) mailing systems are designed to work with a specific SMS gateway hence resulting in user lock-in to a SMS vendor. Also, some SMS gateways support scheduling of SMS message to be sent at a later time and date, others do not support it. Moreover, those gateways that support scheduling don't mostly allow users to cancel scheduled SMS message.

This study has successfully designed and developed an enterprise class mass SMS mailing system that support multiple users as well as multiple SMS gateways, providing a unified interface and common set of features across many SMS gateways which prevent vendor lock-in as users can choose among multiple SMS vendor gateways. Another major feature provided by the new system is the introduction of SMS message scheduling. This feature makes SMS message scheduling possible across all SMS gateways including those that do not internally support scheduling. Moreover, users can also cancel any scheduled message if the need be.

Keywords: Mailing Systems, Lock-In, Scheduling, SMS, SMS Gateway, SMS Vendor.

1. Introduction

The short message service (SMS) technology is one of the most stable and most widely used mobile communication methods after phone calls. Most students of tertiary institutions carry mobile phones which is capable of receiving short messages as a means of event notification. In principle, text message can be used either as a one-way communication to provide the user information such as reminder, alert, etc, or as a two-way communication that enables the user to send and receive information (such as question and answer). Event notification (through SMS) is a well-known way of notifying users about an event scheduled to take effect within a particular period in an institution. Moreover, Mobile text messages are an excellent aid for communication when there is a need to submit information also at long distances or without well working communication system or infrastructure, or when the people cannot physically meet the staff that is concerned, provided that the cost of the text message is very low and it is available to practically everyone. It has been found useful to employ the text messaging in many routine-like academic environment applications. Typical examples of these application areas are e.g. different kinds of reminders and instructions, reporting of laboratory test results or home assessment for students, remote controlling and monitoring etc. By using this kind of communication, it is possible to save resources by e.g. avoiding unnecessary visits and phone calls; the mobile phone messaging in institutions has been a subject of active research work for about a decade.

In this paper, the development of a schedule-able SMS-based system which permits multiple vendor gateways for event notification is presented.

2. Literature review

SMS is an acronym used in the world of communications technology. It stands for Short Messaging Service which is a protocol used in communications that gives way to the exchange of short text messages from one mobile telephone device to another. SMS or text messaging largely dominates today's means of communication since seventy-four percent of all cell phone users send and receive text messages nowadays. The technology behind SMS has paved the way for the rapid growth of improvement of text messaging that has now allowed users to broadcast SMS text messages not just from mobile phones but also from computers with the use of SMS software and through public SMS gateways. The link between text messaging to SMS technology now co notates the terminology of "SMS" as the act of texting or sending text messages even with the use of a different communications protocol.

2.1 The Capabilities of SMS

The use of SMS as an effective means of personal communication has expanded the market of text messaging. Businesses, government offices, and even television shows now use this service since SMS is the quickest way to get a message through from one entity to another SMS text messaging is the most widely used data application on the planet, with 2.4 billion active users, or 74% of all mobile phone subscribers sending and receiving text messages on their phones . The SMS technology has facilitated the development and growth of text messaging. SMS has unique advantages that other non-voice services do not have. It provides a very convenient method of exchanging small bits of information between mobile users. The reasons for the enormous

popularity of SMS have been the fact that this mechanism of sending and receiving messages not only saves time but costs less as well. In many situations one is relatively much more comfortable sending a message via SMS than talking over phone. With new information services and unique value added services being used by the operators the popularity of SMS is increasing further. SMS is also uniquely positioned as a very attractive advertisement medium. SMS should no longer be treated as a value added service in mobile networks. SMS is not only providing a useful mechanism for a host of innovative services over mobile networks but it acting as a point of entry for new data services like WAP in mobile networks.

2.2 Application of SMS services

2.2.1 As a tool to provide SMS car parking technique

The car parking technique is being implemented using the SMS services on cellular phone in Vienna (Austria). It describes how useful these advanced car parking system are in providing drivers with information about the structure of the car park systems and the space available for them to park their cars. The availability of the vacant parking space is calculated by means of sensors installed in the parking areas, which count the number of cars that enter to and exit from the parking areas. Also, the number of parking tickets issued at the tickets counter can be used to calculate the vacant spaces. All this information from the sensors and tickets counters is used to update a central database which stores all the information about the areas of the parking space which is vacant or occupied. The advanced parking system also provides advanced, electronic payment options for the customers. The idea behind this electronic payment option is to prevent the customer for having to wait in long queues to buy a ticket. Queues can cause congestion in areas within and outside of parking facilities.

2.2.2 As administrative tool to support communication in higher institution of learning

According to L. Naismith, (2007) from the University of Birmingham reported that an e-mail to text message service called Study Link is employed to support Administrative communication in higher education. Text messaging can be "effectively integrated into both the student and staff experience". Administrative staff members were able to integrate the service into their current means of communicating with students while students were able to effectively receive and act on text messages. Message types include notices of changes and cancellations (e.g., class cancellations), reminders to submit and collect assignments, notices of relevant lectures/activities, individual administration (e.g., warning messages to absentees), instructional messages (e.g., instructions for submitting assignments), and greeting/courteous messages.

According to S. Pramsane, & R. Sanjaya, (2006) development of education services based on short message services. The education information such as the enrollment information, grade release, university announcement, and internship opportunity can be retrieved and/or sent by the students via SMS through a login system. This research points out that administrative support to students via short message services is ideal.

2.2.3 As a tool to support library administrative work

Library services can be improved through SMS-based administrative support. Libraries can reach out and serve students ubiquitously by sending and receiving SMS-based library information. There are a number of areas in library services for which SMS-based messages can be helpful. Basic information alerts such as notices of book reservations, and renewals and overdue reminders are well tailored with this communication medium. One example is the *SMS* alert services offered by the Hong Kong Institute of Education. Further library services can also be provided via SMS based systems. For example, extended text messaging reference can send SMS messages to and receive answers from librarians as reported in research at Southeastern Louisiana University as a way to further enhance the quality of services provided by libraries in higher education.

2.2.4 As a tool for Teaching and Learning Support (Classroom interaction and discussion)

A SMS-based classroom interaction system is presented in [65]. They called this the *TXT-2-LRN* system. The system allows students to send questions or comments to the instructor's laptop via *SMS*. The instructor can read the messages on the screen and decide to respond immediately or wait for later action. The instructor can also provide a quiz to the students and collect results. Students can look at the projector's screen in real-time graphics showing the results. Short message services encourage interactivity in the classroom, Traxler, J. (2005).

2.3 Related Work

Mobile computing and communication technology interventions for improving health care and health service outcomes, referred as M-health, Free C et al., Patel V, et al. (2010) are used nowadays on a wide range from data collection and information transmission to supporting health behavior change.

Wei et al., (2011) presented a literature review including 24 articles on the use of text messaging for clinical and healthy behavior interventions. In paper of Cole-Lewis and Kershaw, (2010) a review on the behavior change interventions for disease management and prevention delivered through text messaging is presented. Krishna et al. (2009) have made an article on the state-of–heart of the use of mobile phones and text messaging interventions in improving health outcomes and processes of care.

There has been an increasing interest in academic institutions using mobile devices to support teaching and learning. Different mobile devices can be used in mobile learning. The most ubiquitous and stable mobile

technologies namely Short Message Service (SMS) texting (Traxler, 2005) on cellular phones has great potential in education.

In Mozambique health workers can support diagnosis & treatment through Bulk SMS and even in Uganda, Malawi and Benin health education messages are sent by text messages (Pankaj, 2011).

3.System design

The system defines a common interface that all SMS gateway objects must implements. The interface declares an abstract method – send - that will performs the function of sending SMS messages through a specific SMS gateway. The send method must returns an object that contains an error flag that indicates if the send operation was successful or not and the response message from the SMS gateway – the response message will be from a set of predefined set of messages provided by the interface. All SMS gateway objects in the system must implement this interface and define the send method to work with the specific SMS gateway each of the objects represents. The send method definition in each of the SMS gateway objects must also be able to analyze the custom response from the gateway and pick the most appropriate message from the set of predefined messages provided by the interface to be returned to the caller of the send method. This will gives the interface a uniform set of responses across all SMS gateways. The system stores the SMS gateway objects in a naming service that binds each object to the name of the SMS gateway it represents. The system also keeps database record of all the names of the SMS gateway objects in the naming service.

To send SMS message through any SMS gateway, the system simply need to use the name of the gateway to obtain the appropriate gateway object from the naming service. The obtained object can be used to

- Send instant SMS message - the sender of the message will get an immediate response from the system.
- Schedule a SMS message to be sent on a specified date and time in the future – a scheduler will perform the send operation on the specified date and time and notify the sender through an appropriate mean e.g. server side push notification.

3.1 System Architecture

The three-tier architecture model is the structure used for the system architecture. Here is how the three-tier model is incorporated into the system

3.1.1 Client Tier

This is the client side of the architecture. The user will be shown formatted HTML pages resulting from JSP code, which will be submitted to the application middleware for processing. It will actually be the front-end of the system and it is where the user will interact with the system.

3.1.2 Application Tier

This is the middleware side of the architecture. The main application used in this layer is JSP, which will be processed by a web server, i.e. Tomcat. Also in this tier will be the SSL protocol (Secure Sockets Layer) if it is exist, to make sure the system and data is secure from unauthorized users.

The application tier is made up of the following components:

- A naming service for storing instances of the various SMS gateways supported by the system. On start-up, the system will create an instance of each SMS gateway objects and stored them in the naming service.
- A thread pool of n size where n is the number of threads in the pool. For optimal performance and to avoid the overhead of thread context switching, n should not be set too high. For example, on a multi-core system, n should be set equal the number of processor cores on the computer system.
- An executor service that will use the thread pool to execute tasks submitted to it asynchronously.
- A scheduler that can schedule tasks to be submitted to the executor service on a specified date and time. The scheduler must return an object (scheduled task) that can be used to monitor the status of each scheduled task. The scheduler must also be thread safe. The system will maintain a single instance of the scheduler in its application context. All requests handling threads will use this scheduler instance to schedule SMS message.
- The system will also maintain a single instance of a thread safe collection object (scheduled task list) that will hold all scheduled task objects.

To send a new SMS message, the system will obtain the appropriate SMS gateway object from the naming service and call the gateway object send method.

To schedule a new SMS message, the system will obtain the appropriate SMS gateway object from the naming service, create a task object that will act as a closure for calling the SMS gateway object send method, submit the task object to the scheduler instance along with the specified date and time of executing the task, store the scheduled task object return by the scheduler in the scheduled task list.

3.1.3 Back-End Tier

This is the backend side of the architecture and where all the data and records are kept. Also known as the business data, the technology used to store the business data is Postgresql Database Server.

3.2 Interface Design

3.2.1 Login Page

W2This page welcomes the user to the application. It displays and allows the user to **Input** User Id and Password, then click login button; the screen will automatically display the **Home** page, the home page menu will be created depends on the user role. Based on the user login info the system will specify the user Role and permissions and based on those permissions the system main menu which is a dynamic menu will be generated to enable the user to access only his authorized pages of the system.

3.2.2 Manage Contact page

This page allows the user to add new contact information or edit existing ones. The user can group the contacts into groups selects the Add New Event button. In order to delete any contact the user just clicks the delete link beside the desired contact in the grid in order to delete that contact.

3.2.3 Manage Notifications page

This page allows the user to add new notification or edit existing ones. To add new notification, the user will enter the new Notification information and clicks save to store the data in the system database. In order to delete any contact the user just clicks the delete link beside the desired contact in the grid in order to delete that contact.

3.2.4 Send Notifications page

This page allows the user to send new notification to selected contacts. In order to send a new notification first the user selects the desired notification from the list of notification grid. Then the user select a desired group from the drop down list for the contact groups Finally the system will display all contact included in that group and then the admin has to select contacts to be notified and click Send or Schedules Notification button to complete the process.

Conclusion

This study has successfully designed and developed an enterprise class mass SMS mailing system that support multiple users as well as multiple SMS gateways, providing a unified interface and common set of features across many SMS gateways which prevent vendor lock-in as users can choose among multiple SMS vendor gateways. Another major feature provided by the new system is the introduction of SMS message scheduling. This feature makes SMS message scheduling possible across all SMS gateways including those that do not internally support scheduling. Moreover, users can also cancel any scheduled message if the need be.

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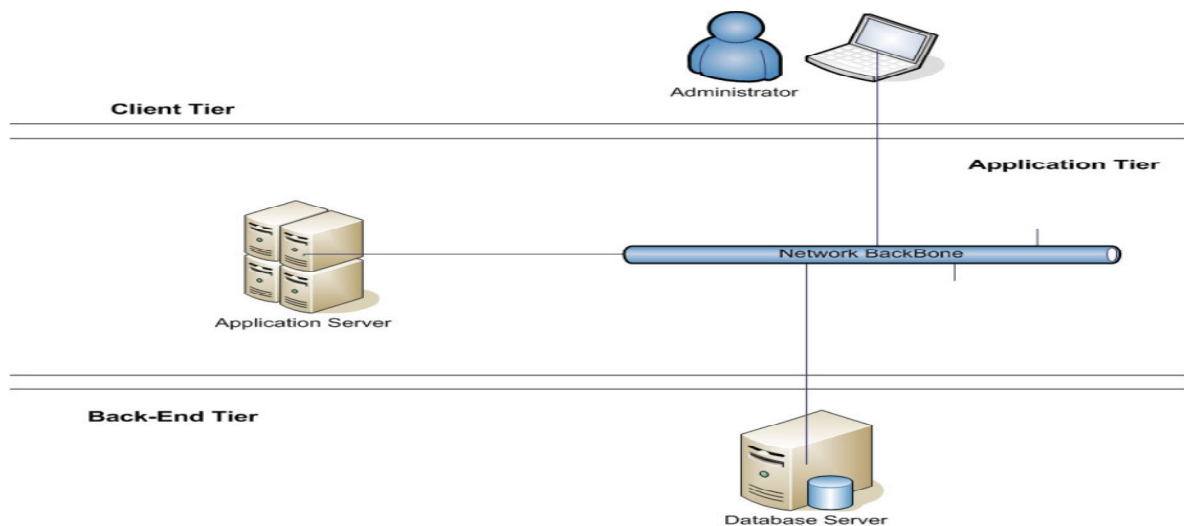
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Figure 1: System Architecture Diagram
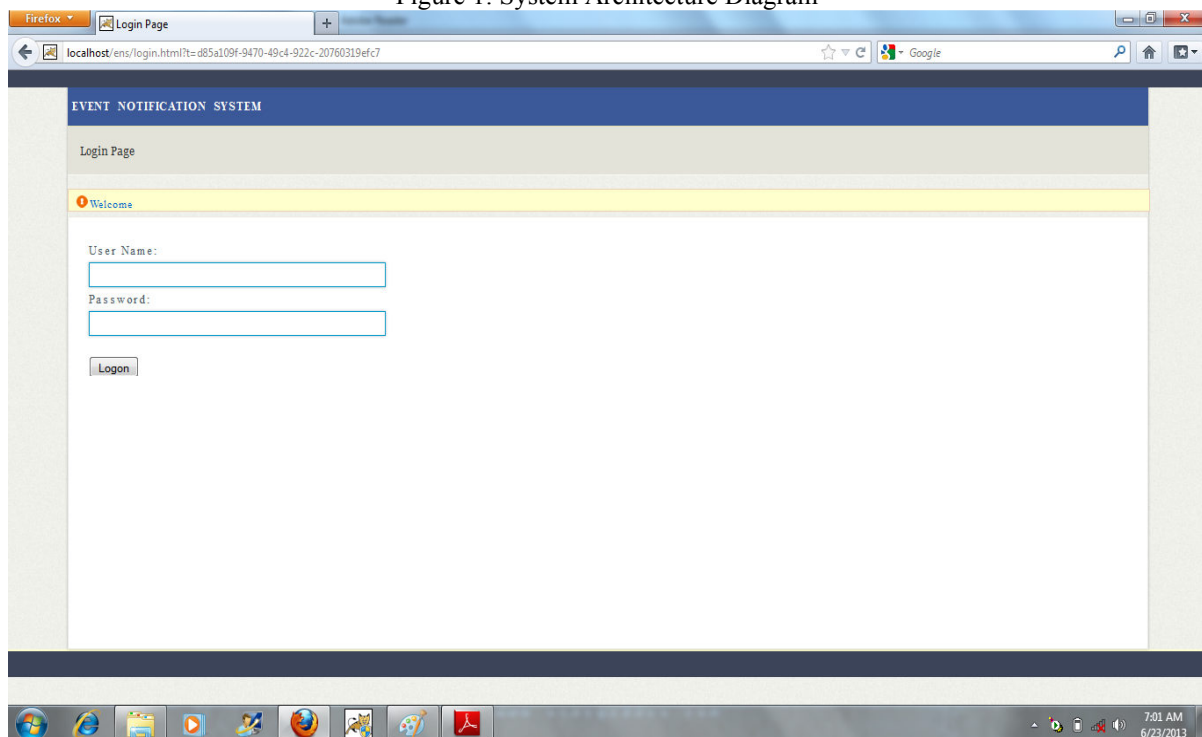
Figure 2: Login Page

Figure 3: Manage contacts page

Figure 4: Add new group/member page

Figure 5: Manage notifications page

Figure 6: Send notification page

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