Auto Notification Service for the Student Record Retrieval System Using Short Message Service (SMS)

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Abstract
Web development in becoming a global knowledge has taken numerous steps to improve its information systems, strengthen internally and externally focused knowledge-sharing activities, and foster broader global knowledge-sharing initiatives, all in support of enhancing the web development and its partners' and clients' access to and sharing of ideas . Most of universities have websites; these websites have links which its content of information of a student such as examination results which is not sufficient to show or provide all the data required. The Student Record Retrieval System (SRRS) has been introduced to overcome the above mentioned problem .In this paper, a new proposed system enhancement to the role of the lecturer in SRRS is presented so as to be more informative to the student. The enhancement to the system aimed to allow the lecturer to pass more information to the student using auto notification of short message service depend on mobile phone for each student.

Keyword:
Student Record Retrieval System (SRRS), short message service (SMS).

1. Introduction

SMS appeared on the wireless scene in 1991 in Europe, where digital wireless technology first took hold [1]. The European standard for digital wireless, now known as the global standard for mobiles (GSM), included short messaging services from the outset. In North America, SMS was initially made available on digital wireless networks built by early pioneers such as BellSouth Mobility and Nextel [1],[2]. In 1998, as the build out of PCS networks based on GSM, code division multiple access (CDMA), and time division multiple access (TDMA) access methods is completed, SMS is expected to enjoy full-fledged deployment. The point-to-point SMS provides a mechanism for transmitting "short" messages to and from wireless handsets. The service makes use of a short message service center (SMSC) which acts as a store and forward system for short messages [2]. The wireless network. Provides for the transport of short messages between the SMSCs and wireless handsets. In contrast to existing text message transmission services, such as alphanumeric paging, the service elements are designed to provide guaranteed delivery of text messages to the destination [1],[2]. A distinguishing characteristic of the service is that an active mobile handset is able to receive or submit a short message at any time, independent of whether or not a voice or data call is in progress. SMS also guarantees delivery of the short message by the network. Temporary failures are identified, and the short message is stored in the network until the destination becomes available [3]. SMS is characterized by out-of-band packet delivery and low-bandwidth message transfer. Initial applications of SMS focused on eliminating alphanumeric pagers by permitting two way general purpose messaging and notification services, primarily for voice mail. As technology and networks matured, a variety of services were introduced, including electronic mail and fax integration, paging integration, interactive banking, and information services such as stock quotes. Wireless data applications include downloading of SIM cards for activation, debit, and profile editing purposes [1][2] [3].

A. SMS Overview

SMS stands for Short Message Service, which is a communications protocol used to send and receive text messages [3]. This acronym has now been adopted as a synonym for text messages - short (typically a maximum of 160 characters) text messages which can also be referred to as texts. The most common application of the service is person-to-person messaging, however text messages are also often used to interact with automated systems, such as ordering products and services for mobile phones, or computer to mobile (or vice versa) messaging [2][3]. Some mobile devices are also capable of accessing the Internet. Such access does not require a desktop computer, or a fixed landline connection. However, for the purposes of this introduction, we have focused on text messaging rather than mobile internet, as SMS is available on almost all mobile phones in New Zealand. SMS is the delivery of alphanumeric messages to mobile phones over wireless networks. The length of the message can be no longer than 160 characters. In Europe, Two-way SMS messaging has been popular for some time and is slowly gaining popularity in North America as some of the major wireless networks (like AT&T) are beginning to support it.

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SMS is a universal data service and is supported on GSM, TDMA, and CDMA networks. An SMS message can originate from an external system Such as e-mail or mobile device and is routed through the network, via the short messaging service center (SMSC), to its destination. A distinguishing feature of SMS is its ability to deliver messages any time, regardless of whether data or voice calls are in progress [3].

B. Benefits of SMS

SMS first appeared in Europe in 1991 as part of the Global System for Mobile Communications (GSM) Phase 1 standard. SMS was made available in North America recently, and was first adopted on digital networks built by early wireless carriers such as BellSouth Mobility, Nextel, and AT&T. SMS is supported on digital wireless networks based on GSM, code division multiple access (CDMA), and time division multiple access (TDMA). In today's competitive world, differentiation is a significant factor in the success of the service provider. Once the basic services, such as voice telephony, are deployed, SMS provides a powerful vehicle for service differentiation. The benefits of SMS to the service provider are as follows [3],[4]:

- Increased call completion on wireless and wire line networks by leveraging the notification capabilities of SMS
- An alternative to alphanumeric paging services
- Enabling wireless data access for corporate users
- Provision of value-added services such as e-mail, voice mail, and fax mail integration, reminder service, stock and currency quotes, and airline schedules
- Provision of key administrative services such as advice of charge, over-the-air downloading, and service provisioning
- Guaranteed delivery of notifications and alerts to single or multiple users
- Increased user productivity through instant delivery of notifications and alerts
- Low cost and reliable communication mechanism for information delivery
- Integration with Internet-based applications
- Another service and source of revenue for service providers
- Very possible replacement of existing two-way paging.

All of these benefits are attainable quickly with modest incremental cost, and typical investment payback periods are less than six months. The benefits of SMS to subscribers center on convenience, flexibility, and seamless Integration of messaging services and data access. From this perspective, the benefit is to be able to use the handset as an extension of the computer. SMS also eliminates the need for separate devices for messaging since services can be integrated into a single wireless. Device — the mobile terminal.

C. SMS architecture description

The following are descriptions of the SMS architecture elements [1][2][4]:

- **MS** -- Mobile station, a wireless terminal that is capable of receiving and sending alphanumeric messages.
- **SME** -- Short message entity, which can be a device like a mobile phone, or an application like e-mail that is capable of receiving and sending alphanumeric messages.
- **SMSC** -- Short message service center, responsible for storing and forwarding messages to and from the mobile station.
- STP -- Single transfer point, which allows for interconnections over signaling system 7 (SS7) links and multiple network elements. For more information on SS7 links, see the Resources section.
- **HLR** -- A database in the network that holds information like subscriber and service profile, as well as subscriber. Routing information for the subscriber is also stored in the HLR, which is requested by the SMSC.
- **MSC** -- Mobile switching service center. The job of the mobile switching service center is to switch connections between mobile stations, or between mobile stations and the fixed network.
- **BS** -- Base station, which relays information to and from the mobile station to the
- **MSC**. The BS consists of controllers and transceiver stations, also known as "cells."
- **MS** -- Mobile station, a wireless terminal that is capable of receiving and sending alphanumeric messages.

D. SMS Network Infrastructure

This figure illustrates how SMS can be integrated with applications over the Internet and applications within a LAN/WAN/Intranet. Integrating applications like notification services (voice/fax, reminder, calendar, etc.), e-mail, information services (weather alerts, stock alerts, etc.), and WAP integration are some examples of easily integrating SMS [4].

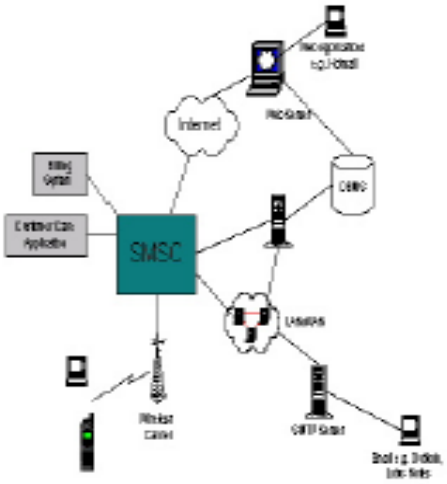

Figure 1: SMS Network Infrastructure [4].

E. SMS Applications

i. Consumer applications

Examples of SMS consumer applications include [1][2][3][4]:

- **Peer-to-peer messaging:** This is the most common type of use of SMS. A message like, "Hello, how are you?" or "Meet you at 8:00 PM for dinner" is usually exchanged between two mobile users. This is a quick, efficient, and inexpensive method of communication.

- **Information services:** Information services include stock quotes, weather forecasts, and news updates. A simple SMS application would require a user to type in "ST" for stock quotes or "WEA" for weather forecast. Upon submitting the request, the user receives the appropriate information in the form of an SMS message.

- **Advertising:** SMS can be used to send targeted alerts to a user. The user would sign up to receive special alerts informing the user of upcoming events. Additionally, businesses can use SMS as a form of low-cost advertising.

ii. Commercial/enterprise applications

Examples of SMS commercial/enterprise applications:

- **Customer service**: SMS can be used as a customer service tool, thereby avoiding expensive person-to-person voice calls to customer service centers. This is an efficient and inexpensive method of providing account status and other pertinent information.

- **Job dispatch**: SMS can be used in job dispatching applications to communicate information between office-based and mobile staff. Sending an address to a message courier in the field is one example of a job dispatch application. The dispatch application can be integrated with other applications, such as vehicle positioning applications.

F. Limitations of SMS

- The message length is limited to 160 characters; this is ideal only for simple text messages.
- SMS does not support audio or graphics.
- The store and forward mechanism of SMS, though very useful, does not make it suitable for WAP applications.
- Slow data rate and latency. The signaling channel used by SMS is used for other purposes, which tends to slow the message transmission data rate.
- The SMS protocol data unit, as defined in the GSM 03.40 standard, is not flexible. Header fields, including Data Coding Scheme and Origination Address, are fixed. This can sometimes constrain application development. 3G specifications will include a Tag Length Variable structure to address the SMS message structure's inflexibility.

2. Methodology

A good software development practice starts with a good understanding on the user requirements .A requirement is a feature of the system or the description of the something that the system is capable of doing in order to fulfill the system's purpose[5].Requirements are to be defined according to two categories which are the functional requirement and non-functional requirement (Kendall, 1996).The functional and non-functional requirements of SRRS are gathered by way of:-

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A. Software Process Model

The system development methodology is a method to create a system with a series of steps or operations or can be defined as system life cycle model. Every system development process model include system requirement such as user, needs and resource as input and a finished product as output as show in figure 2 [6].

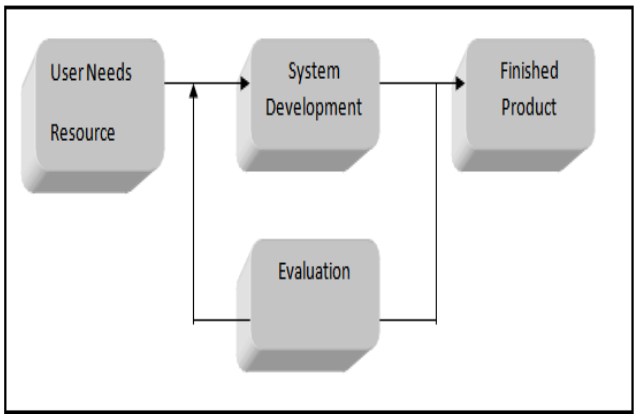

Figure 2 System Process Modes [6].

A software process model is an abstract representation of a software process. Each process model represents a process from a particular perspective, and thus provides only partial information about that process [6],[7]. The process model that is used to develop the system is the incremental model .This model uses the waterfall model in an iteration fashion. It focuses on the delivery of an operation product with each increment. It works well to address technical risk management and ramp staffing with the complexity of the work.Figure3 show the incremental model [6],[7].

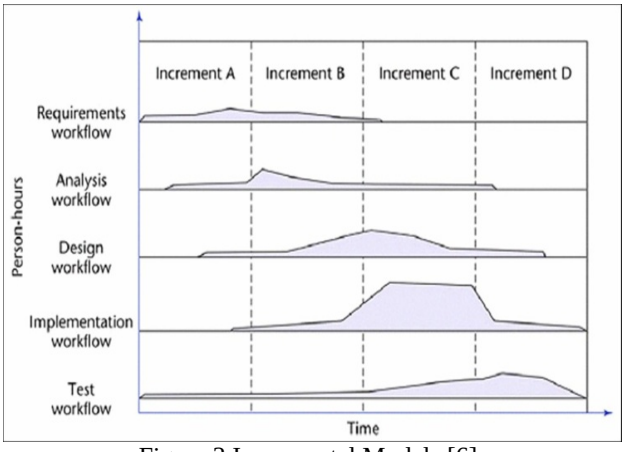

Figure 3 Incremental Models [6].

B. *Choice of Incremental Model*

The incremental build model is a method of software development where the model is designed, implemented and tested incrementally until the product is finished. It involves both development and maintenance. The product is defined as finished when it satisfies all of its requirements[6],[8].

This approach is favored by many object-oriented practitioners. It basically divides the overall project into a number of increments, then it applies the waterfall model to each increment [6]. The system is put into production when the first increment is delivered. As time passes additional increments are completed and added to the working system. The incremental development model for object-oriented project comprises the following phases [8], [9]:

i. Requirements Workflow

The first phase of this development involves the Requirements specification, which is the usual starting phase of all software process models. The requirement needs to be determined at the beginning phase of the project. It includes users of the system, the system's services, constraints and goals. These requirements are described and defined in details, serving as the system specification [6]. Those analyses involved the functional requirements and the non-functional requirements. These sets of requirements are based upon extensive use and development of SRRS. Some of the requirements were gathered through user feedback and user requests conducted in an informal manner. The main goal of these requirements is to develop a system that enables student to check their recorded data. In this phase, the information about the user's requirements shall be gathered and documented. This phase can last from a few days to few weeks and is usually carried out on-site or through customer communication. Discussions shall be held to understand the user's requirements. The software requirements shall be documented. The documentation shall use the terms familiar to the customer and shall encompass the entire functionality of the product as foreseen by the customer (Student) [6].

A review of the user requirement document is to be done. User's requirements will then be converted to implementation specific statements. The user-interface shall also be detailed. The user's software requirements shall be thoroughly understood to convert to system specifications. The software requirements specifications shall be documented using ***Use Case diagrams.*** The documentation shall use the implementation specific terms for the ease of understanding for the designers and developers.

ii. System Analysis and Design Workflow

The next stage involves identifying and prioritizing user requirements. User requirements are prioritized and the highest priority requirements are included in the early increments. In this phase, the use cases are identified, the deployment and component diagrams are designed. The system design document shall be prepared [6]. As we are developing web-base application framework and subsequently build SRRS based on this framework. The

framework components that need to be developed are identified as follows:-

- Design of framework architecture
- Setting up application server
- Design of security model

Once the base (framework) has been developed, we need to identify the components required for setting up SRRS system. The components that need to be developed are identified as follows [6].

- Design and implementation of the new database management system
- Design of the user client interfaces
- Design of user manager module
- Design of security module

iii. Implementation Workflow

In this phase, the actual coding shall be done according to the programming standard. The code shall be unit tested. The programming standards to be used shall be identified. This is one of the most critical phases as failure in coding will result in collapse of the whole project. New training skills are required, which have to be learned or developed. While system analysis and design workflow identifies the components that need to be developed, this phase develops and implements all the design requirements identified in the earlier phase.

The development involves the implementation of SRRS. This phase involves the installation of .NET framework 2.0, the Microsoft Access 2000, and the programming environment, which is ASP.NET. In order to implement this phase, new skills have to be developed. Specifically, this means learning the ASP.NET programming language, the .NET Framework, and how to implement Microsoft Access 2000 functionality [6].

iv. Testing Workflow

In the system-testing phase, the product shall be tested module-wise and the interdependencies among the modules shall be validated. The functionality of the product shall be tested as a whole. The product needed to be tested for conformance with the system requirements, that is, the overall goal of the project. At this phase, user involvement is vital to the design, redesign and validation of the user interfaces. During the user acceptance-testing phase, SRRS system shall validate against the user requirements, acceptance criteria and acceptance data. Figure 4 shows the incremental development system.

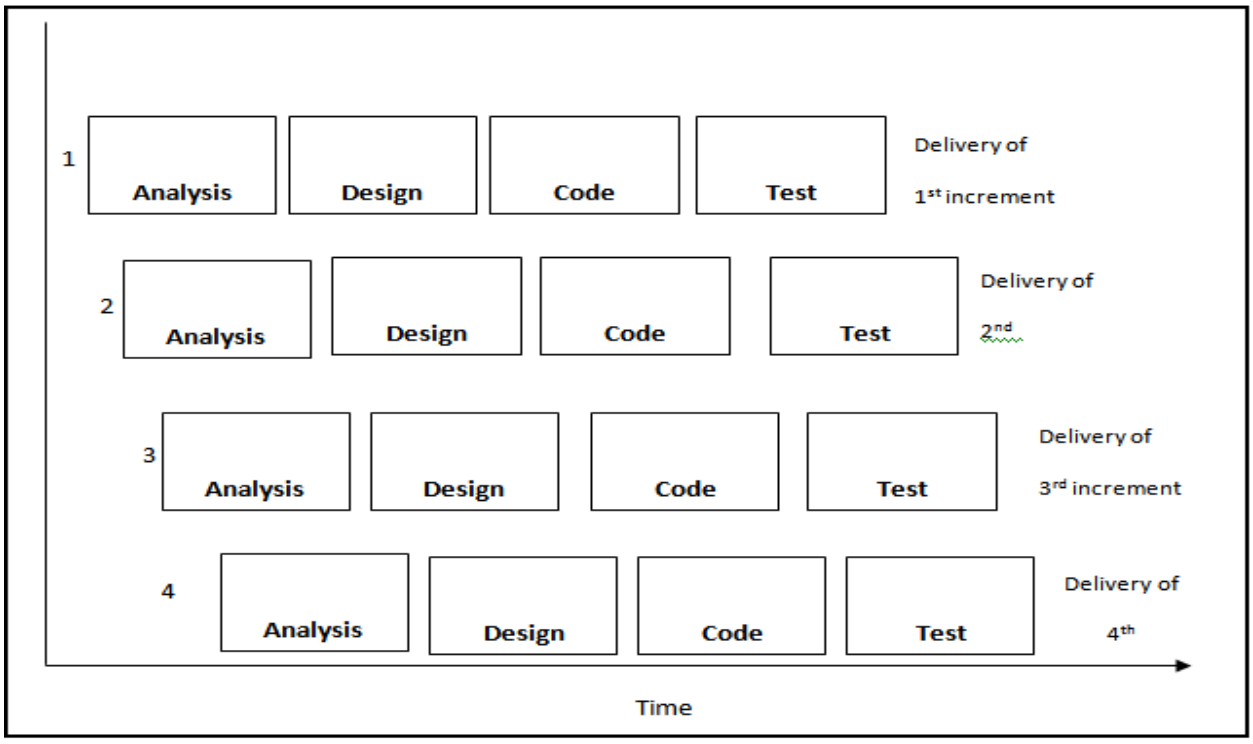

Figure 4 Increment Deployment Cycle [6].

C. Advantages 0f Incremental Development Model

- There is a lower risk of overall project failure. Although problems may be encountered in some increment, it is likely that some will be successfully delivered to the customer.
- Customers do not have to wait until the entire system is delivered until they can gain value from it. The first increment satisfies their most critical requirement so the software can be immediately used.
- It provides an opportunity to explore alternative strategies and revisions.
- Early feedback is generated because implementation occurs rapidly for a small subset of the system.
- It ensures that the developers build the right system according to the specification and verification of the system.
- More flexible on requirements change.
- More parallelism saves lots of time! However, there are still some weaknesses in this model
- Extra time spent on testing, documenting and maintaining a "temporary" product.

3. System Analysis of SRRS with SMS

A. System Requirement Analysis

The purpose of system requirements analysis is to get a thorough and detailed understanding of the business need as defined in Project Origination and captured in the Business case. Generally, Requirement analysis always classified as functional requirements and non-requirement [6],[9],[10],[11].

i. Functional Requirement

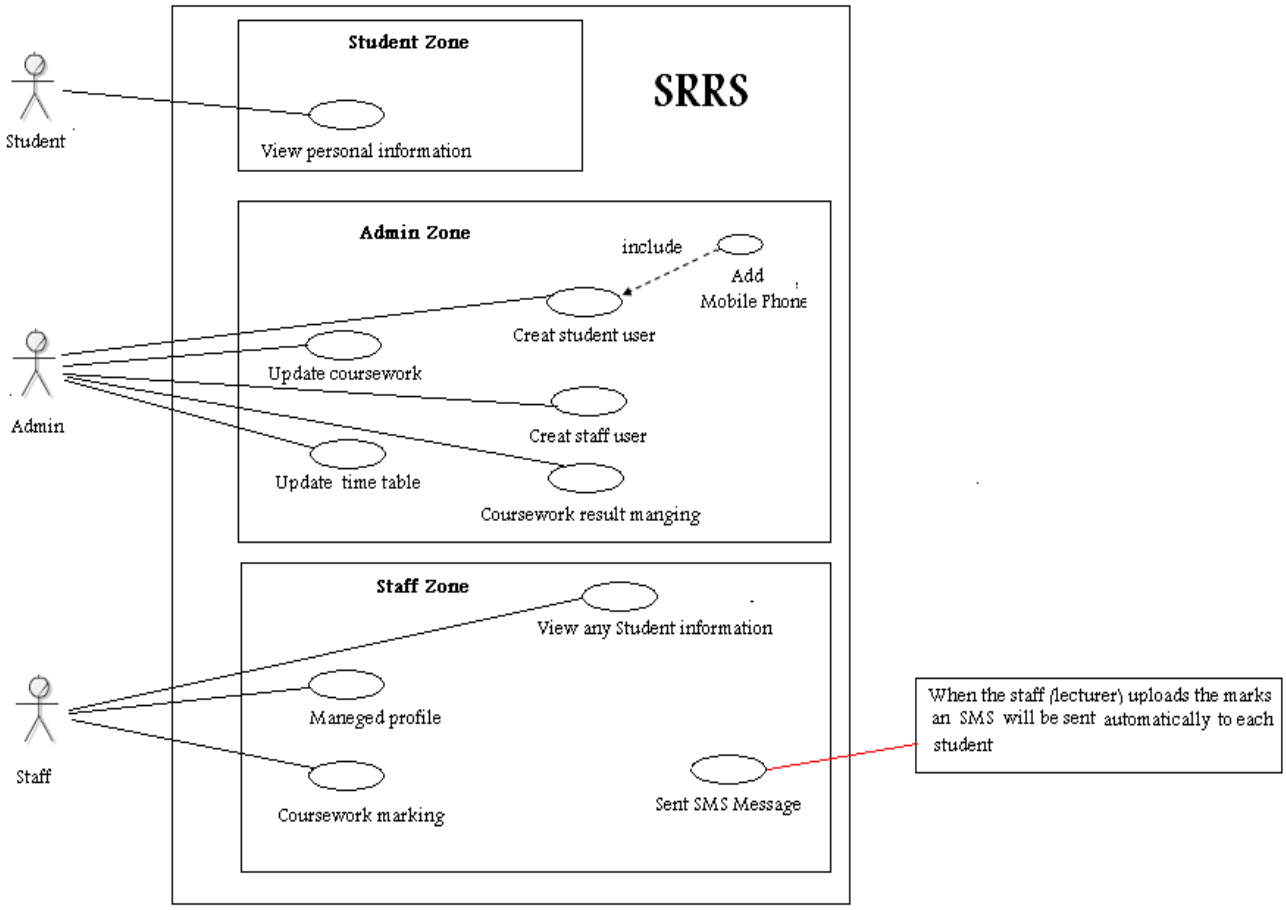

Figure 5: System Module

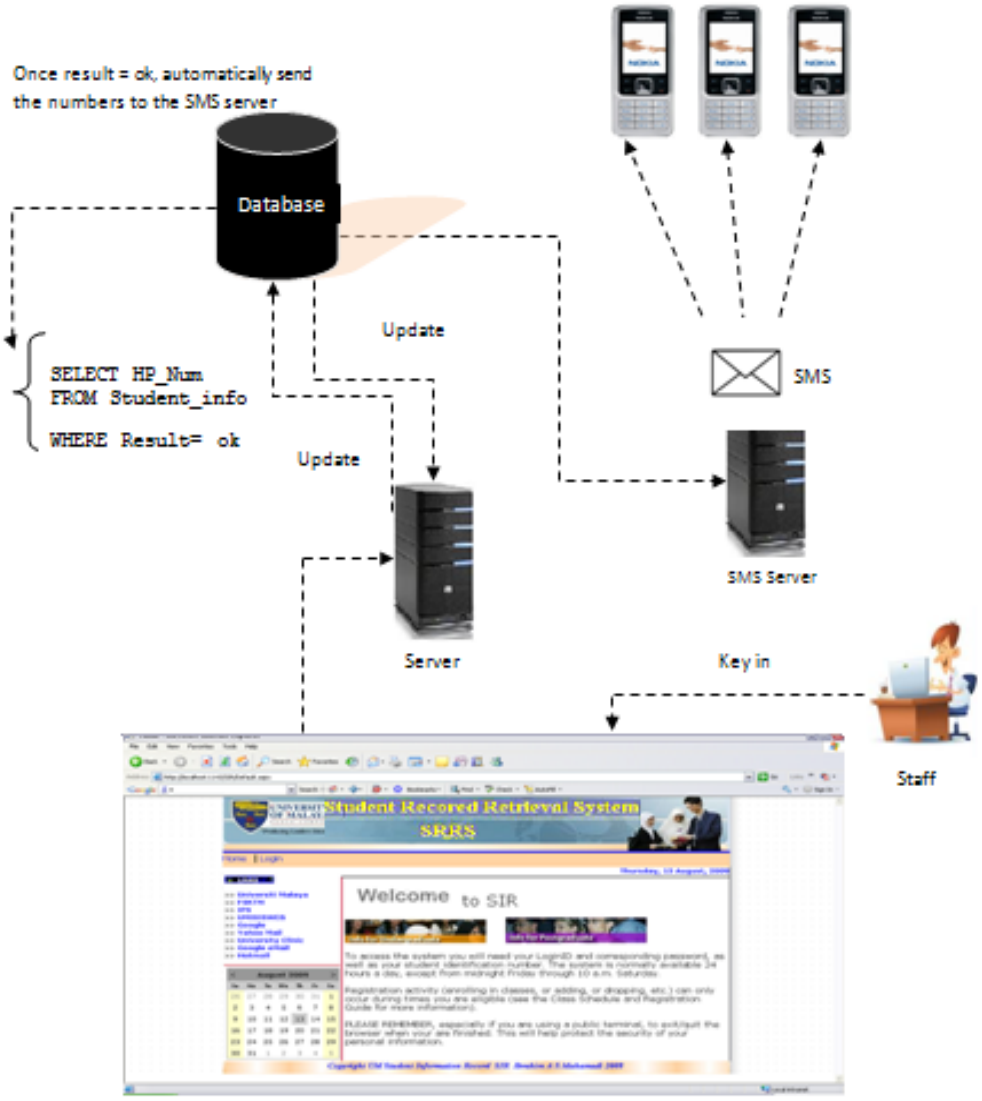

Figure 6: System Module for Send SMS

ii. Non-Functional Requirements

- Extensibility – the prototype was developed in n-tier architecture and implemented with object-oriented solution, which provided easy management and good extensibility. This was proved throughout the implementation of the prototype, where changing requirements and adding functionalities did not introduce extra work; should further enhancements be applied, they can be "plugged in" to the existing prototype with minimum costs[6][12].

- Conformance *and consistency* – design and implementation generally conformed to the online portal; original interface was preserved with small improvements; functionalities were delivered based on the online portal; presentation consistency was maintained, a bug9 was found during testing but fixed[6][12]

- Usability – the prototype generally provides good usability; realization of each functionality was achieved through a number of pages, which ensures users not to be overloaded with information at once; users can obtain feedback for their actions; validations on user inputs prevent users from incurring errors to the system; users are informed of

system errors, however details of errors are not displayed, which challenges usability [6][12].

- Security – security was considered to be weak in the prototype. Although authentication was implemented, this is far less adequate for a secure web application. Other solutions such as firewall, encryption etc should have been considered [6][12].

- Performance – quick response was enhanced by the selection of data passing and retrieving methods. However there are also potential risks of having server overloaded, such as session state and caching, which occupy server memories. In reality, servers should be clustered to balance workload, ensuring performance and providing good scalability; apart from this, separation of tiers and object-orientation increases message passing, which could undermine performance. Unfortunately this was not tested and therefore can not be commented in details [6][12].

4. Conclusion

To conclude, this paper has presented an enhancement to the SRRS (Student Record retrieval System) by having an SMS automatically being sent to each student once a lecturer submits a marking to their records. This operation will ensure the student be informed of the new data arriving to his record so that he might go and check his new info or data specially a mark or an examination result

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