Operational Customer Relationship Management (CRM) using Short Message Service (SMS)

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Abstract – To make sure that customer receive a personal attention, the front-office officer calling customers day by day to remind customer to maintain their vehicles regularly. This routine was done by phone, called Maintenance Reminder System (MRS) but this process considered costly and takes much time. In this paper, we will propose new model to remind customer utilize short message service. By using our proposed model, the service provider company gained cost effectiveness and increase time efficiency. According to the result, using short message service (SMS) system can remind 5-10 customers to maintain their vehicles within a minute more efficient compared to calling customer one-by-one. In this work we use data retrieved from System Aplication and Product in Data Processing (SAP).

Keywords: Maintenance Reminder System, Short Message Service, Operational Customer Relationship Management

1. Introduction

The most ubiquitous and stable mobile technology namely Short Message Service (SMS) texting [1] on cellular phones has great potential to support business toward customer relationship (create new and maintain). In 2001, 700 million mobile phone users worldwide sent an average of 20 billion SMS messages every month. Indeed, the volume of SMS messages sent in December 2001 was 30 billion worldwide and it was expected to grow to 100 billion by the end of 2002. In Europe, Norway leads the region with an average of 47 messages sent per month per user in 2001 while Philippines lead the Asia-Pacific region with 336 SMS messages [2]. Given that the huge SMS messaging customer base could potentially serve as major component of the SMS-commerce customer base, many commerce providers are becoming more interested in SMS commerce applications [3]. Text Message Service (SMS) messages are handled by Short Message Service Centre (SMSC) that sending message in two-type of paradigm namely store-and-forward or forward-and-forget paradigm, these paradigm made SMS to be more effective communication compare to customer in some cases. In the store-and-forward paradigm, the system resends the message for some period of time until it is successfully received. In a forward-and-forget paradigm, the system sends the message to the end device without assurance of receipt or an attempt to redeliver in the case of failure [4]. 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 [5][6]. SMS is becoming a widely used communication mechanism for mobile phone users, seeing that SMS facilitates person-to-person messaging, interactive information and entertainment services, and lately location-based services [4].

Three consistent success indicators for SMS messaging [7] are: (1) the cost-effectiveness and interoperability of the wireless infrastructure; (2) the high penetration of mobile phones (ubiquitous

penetration levels of over 80% in some countries); and (3) the relatively low cost of the SMS messaging service. Also, some research believe meaningly interprets that cost of SMS does matter to consumptions [7]. This functionality is increase of interest to service provider industry due to the service provider can interact with their customer anytime and effectively and more flexible compared to call customer one-by-one.

In this paper, we proposed new model of interacting with customer and give close attention to customer personally, these attempt were parts of operational customer relationship proses. The system automates customer care using short message service. The message service comprises of reminders to maintain the customer's vehicle, administration (e.g., booking), home services, greeting/courteous message, and inform customers of new services.

2. Related Work and Motivation

As a business strategy "Customer Relationship Management (CRM) is a customer-focused business strategy that aims to increase customer satisfaction and customer loyalty by offering a more responsive and customized services to each customer [8]. Reference [9][10] was articulated that the objective customer relationship is to form customer's perception of an organization and its products through identifying customer, creating customer knowledge and building a relationship. Customer relationship management is extending into three levels; strategic, operational and analytical [11-12]. To keep the customer service provider company have and add new one, the company need to make close relationship with customer, the relationship can be done by calling customers every day whether on the web, by phone, or via mail to give close attention personally. Operational CRM deals with automation and streamlining workflow at the front office which includes collecting data, processing transactions, and controlling workflow at the sales, marketing, and services [13-17]. The analytical type deals with increasing customer and organization value using the customer data. Analytical CRM builds on operational CRM and analyze customer data to create information about the customer segmentation, customer behavior, and customer value to the organization using statistical analysis tools especially the data mining [13-15], [17].

Initially, to make close relationship with its customers, service provider company made a mechanism to remind customer to maintain their vehicles. Service provider company notify and remind customer by phone, this mechanism was costly and took much time to remind customer one by one. Before remind notify and customer by phone, the front-office officer estimating the time when customer's vehicle should be maintain for the next period accordance to historical data retrieved from System and Application and Product in Data Processing (SAP). The estimation was done by using a tool, but the tool has a lack in estimation result, inaccurately. Base on result given by tool (i.e., list of estimated customer), then front-office officer notify and remind each customer to maintain their vehicle by phone (call customers one-by-one). Need much time to call all of customer and spend much money to remind customer by phone. Hence, front-office officer decided to choose and call potential customer. Accordance to this lack, we proposed new tool (more accurately result) and adopt Short Message Service (SMS) technology to notify, remind customer to maintain their vehicle and customer administration (e.g., booking service and booking home service). Utilizing Short Message Service to notify and remind customer can be the effective way, SMS guarantee delivery of notifications and alerts sent to single or multiple users and increased user productivity through instant delivery of notifications and alerts [18].

The main objective of our proposed enhance the previous mechanism and able effectively inform and remind customer to maintain their vehicle on text message.

3. System Overview

To automate this proses (i.e., remind customer to maintain their vehicle, customer administration such as make an appointment and booking home service), first of all customer should fill in their phone number in application form. This phone number will be used to inform and notify the customer to maintain their vehicle when the time has come (the time will be estimate by system automatically). To forecast the time (customers will come to garage to maintain their vehicle for the next period); the service provider company should have two previous record of each car. System will use all previous kilometer records to forecast when customer will be come to garage and maintain their vehicles. After forecasting is complete, system will send text message to

remind customer to maintain their vehicle for the next few day. The notification will be send to customer within two weeks before estimation day (if estimation day is 14th, then notification would be send on 1st). This mechanism chosen, we realize that customer will need time to decide when they will come to garage to maintain their vehicle.

Figure 1 illustrates the whole proses of system development. Customer's historical data in database forecasted by system to gain the estimation date or day, and send reminder message accordance to estimation result. Database consist customer's historical service can be connected to SMS Server to supply data or can be uploading as external data (e.g., excel file or text file). Whereas figure 2 illustrates the text message would receive by customer.
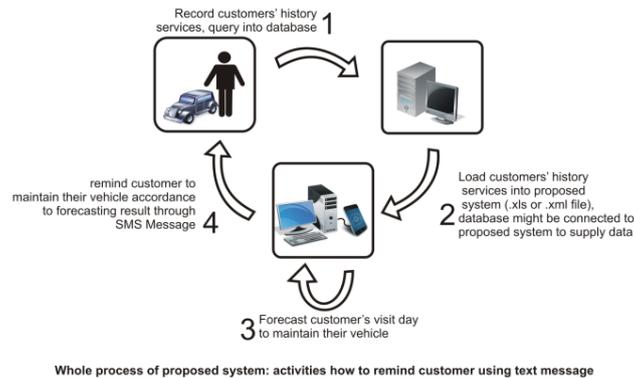

Figure 1 . Whole process in the system

Figure 2 . Message sent by System.

The system development supporting two-way communication, it means customer can interact with service provider company through short message service. Customer can reply notification or reminder sent by system, and customer's reply might be considered as appointment or booking in case message format match in comparison to format defined by system. Message server will send a message alert if customer send wrong message format.

When customer replies the message sent by system, first of all system will check the SMS from the mobile phone and translate from Protocol Data Unit (PDU) format into plain text. In the PDU mode, a complete SMS Message including all header information is passed as a binary string (the opposite, text will be translate into PDU format before send to receiver) [19]. The translation message will be read and divide into three part (i.e., keyword, police number, address is optional for home service only) and compare keyword (in text message) to identified keyword (in message server). If the message format matched, system will store the message accordance to the format sent (there are two type of message format identified by system i.e., appointment and booking home service). The opposite, system will send a notification message inform that the message sent by customer was unidentified format or wrong format. Figure 3 below shows how system read and respond the message sent by customer, then store the message in database when SMS server received right format. Figure 4 illustrated alerting message due to invalid message format sent by customer. Throughout customers send a wrong format, system will send the alert message informed that the message

sent by customer was unidentified by system. This repetition will always continue as long as system receives unidentified message format sent by customer.
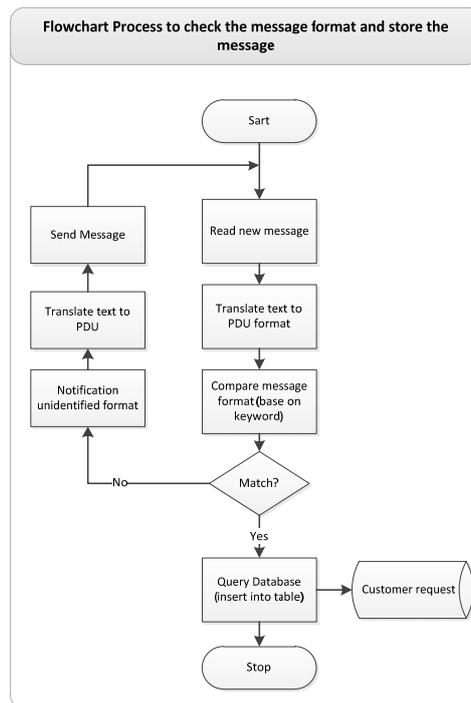

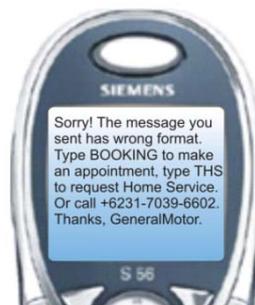Figure 3 . Reading and Responding Message.

Figure 4 . Message Alert Due To Invalid Message Format.

To avoid this repetition happen steadily, alert message sent by SMS Server contains guidance how to reply message correctly corresponding message format identified by system. Customer might call the customer representative or customer service for further information or make appointment to maintain their vehicle.

4.   Scenario Implementation and Analysis

To test and measure reliability of our model, we present three scenario; these scenarios are related to function that system should do. The three scenarios are:
(1) How to forecast when customer should to visit garage to maintain their vehicle
(2) Reminder customer to maintain their vehicle trough Short Message Service (SMS)
(3) Alerting customer regards invalid message format.
(4) Submitting customer request into data.

These scenarios were representing whole proses of our system. We carried out all main proses of our system through these scenarios to gain good point of view how operational customer relationship management done using short message service through our proposed system.

4.1 Algorithm Scenario One;

This scenario forecast shows how system forecast the time when customer due visit garage to maintain vehicle. Accordance the result of this scenario system will send short message to inform or remind customer to maintain the car. This scenario will forecast how long the car reaches next 10000 kilometers (generally, the car will be maintain when reach 10000 kilometers of usage).

Algorithm scenario one
    Input: customers' service records
    Output: estimation day
Begin
Step 1: Upload customers' service records contain (police number, address, kilometer stated, and execution date of maintenance) into system.
Step 2: calculate average kilometer per day. Forecast how long the car will reach next 10000 kilometers (first of all system will count the average kilometer usage per day).
Step 3: show estimation day of all customers.
End;

4.2 Algorithm Scenario Two;

Accordance to the result of scenario one, system will remind customers to maintain their vehicle using text message. System will send message to the nearest estimation result from day while estimating performed.

Algorithm scenario two:
    Input: police number, estimation day, phone number
    Output: SMS Message, notification message that remind customer to maintain their vehicle.
Begin
Step 1: Make sure phone number was a valid input, and insert message to SMS_RECEIVER table (this table contains outgoing message).
Step 2: The SMS server will be always active. Translate the message into Protocol Data Unit (PDU) before ready to send.
Step 3: Check if the message has been Inserted into the SMS_RECEIVER table in the Local database as an outgoing Alerting massage, mark as sent. At the end, this message should be received by the DBA in his mobile phone.
End;

As the result of our scenario, the outgoing message in the SMS_RECEIVER table should be same as the message that shall get to a customers' mobile phone.

4.3 Algorithm Scenario Three;

As mention earlier, our proposed system supporting two-way communication. Customer can interact with system by reply the message. The third scenario will show how system read and process the message sent by customer and send alert message when customer sent invalid message format

Algorithm scenario three;
    Input: Text message (keyword)
    Output: Alerting text message due to invalid message format.
Begin
Step 1: Retrieve message from phone and translate message from Protocol Data Unit (PDU) format into text. Insert into INBOX table. Make sure the message in modem or phone deleted.
Step 2: Read new record in INBOX table and divide as parts and compare to format identified by system.
Step 3: if message format doesn't matched, then system will sent message alert due to invalid message received. Before send alert message, system will translate message into Protocol Data Unit format.
End;

As a result the outgoing message should be same as the alert message that shall get to a customers' mobile phone.

4.4 Algorithm Scenario Four

This is the last scenario to test and measure our proposed model. This scenario will show how system responds the message sent by customers. Previous scenario show how system alert customer regards invalid format, this scenario system responds valid format.
    Algorithm scenario four:

Input: Text message (keyword)
Output: Appointment or booking.
Begin
Step 1: Retrieve message from phone and translate message from Protocol Data Unit (PDU) format into text. Insert into INBOX table. Make sure the message in modem or phone deleted
Step 2: Read new record in INBOX table and divide as parts and compare to format identified by system.
Step 3: If message format matched compare to format message identified by system, system will submit a query corresponding keyword. In case keyword was an appointment system will query database as new appointment. Else, if keyword was a booking home service, system query database as booking service.
End;

At the end of this scenario, system will creates new appointment or booking and save it in database corresponding the keywords. The keyword would be BOOKING for appointment or THS to request home services.

The all of scenarios will always executes when send remind or alert message toward customers and read message sent by customers. Send message to ten correspondents or customers were conducted using three GSM operators they are Mentari, XL, and Simpati to test our systems. As the result of test we discovered average time of sending short message service less than 10 second. The performance is not affected by the connection between the computer and the mobile phone or GSM/GPRS modem (i.e. the SMS sending rate is about the same no matter the mobile phone or GSM/GPRS modem is connected to the computer through a serial cable, USB cable, Bluetooth link or infrared link) and does not depend on whether a mobile phone or GSM/GPRS modem is used (i.e. the SMS

TABLE I. DELIVERY TIME TO SEND MESSAGE

Number Message Sent	Delivery Time For Each Operator (s)		
	Mentari	Simpati	XL
1	15	10	9
2	10	25	9
3	40	20	8
4	20	10	30
5	15	9	15
6	10	20	10
7	10	30	15
8	9	53	9
9	9	9	8
10	8	9	6
Average time	14.6	19.5	11.9

Sending rate is or a GSM/GPRS modem is used). The determining factor for the SMS sending rate is the wireless network. [20]

5. Conclusion

The proposed system can automate the some routines of operational relationship management effectively and efficient in the term of time using Short Message Service (SMS). Using proposed system, front-office officer can remind and keep in touch with customers without break their time up. The system can send text message or inform 5-10 customers within a minute. As result our proposed system more effective than calling one-by-one to remind or inform customers. Our proposed system can further be enhanced by using its feature to it like front-office officer can send short message to customer contains advertising or other information if necessary.

Our proposed system conducted by GSM modem or GSM phone due to company send the small amount of SMS messages. To send the large amount of SMS Message, developer can obtain direct connection to Short Message Service Centre (SMSC) but it might be costly.

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