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Making Machines Talk with Intelligent Senses

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Abstract— Availability of Awareness Indicators like last seen, message read notification, message delivery status, and message typing notification plays a very prominent role in today's digitalized e-world. It facilitates natural and effective communication across instant messages sent. Like the 'typing' awareness indicator feature can be seen like an eye contact in an ongoing conversation among conversant regarding whether the receiver is paying attention to sender or not. Hence these indicators control level of anxiety among sender to some extent regarding delivery status and read receipt of sent message. It's just like a 'creaking door noise' to notify sender about arrival of recipient and 'slamming of door' when any of the conversant leaves. This availability of awareness indicators closely resembles any face-to-face interactions where exchange of messages is often short, quick and many a times even incomplete sentences. Due to this existing conversational style of Instant Messaging there is a necessity of maintaining awareness among conversant engaged in an ongoing conversation that assist's them to decide whether or not they should move ahead in a conversation. Awareness about other user's activities facilitates coordination of messages naturally and effectively as if it would have been in any face to face interaction. Most of the awareness features are available in popular IM clients such as Gtalk, Yahoo, Skype, Whatsapp, Line, WeChat etc. But suppose if a sender wants to know about the activities of the recipient in an ongoing conversation over a SMS service that's available over cellular network that too without internet access. Then SMS service is missing this capability of maintaining awareness among sender and receiver in a conversation. This idea of adding text messaging functionality to mobile devices began in the early 1980s and by 1984 the concept of SMS came into picture over cellular network. The need of including awareness indicators even over cellular network in SMS services like its already available in existing IM clients over internet is the main motivation behind writing this paper.

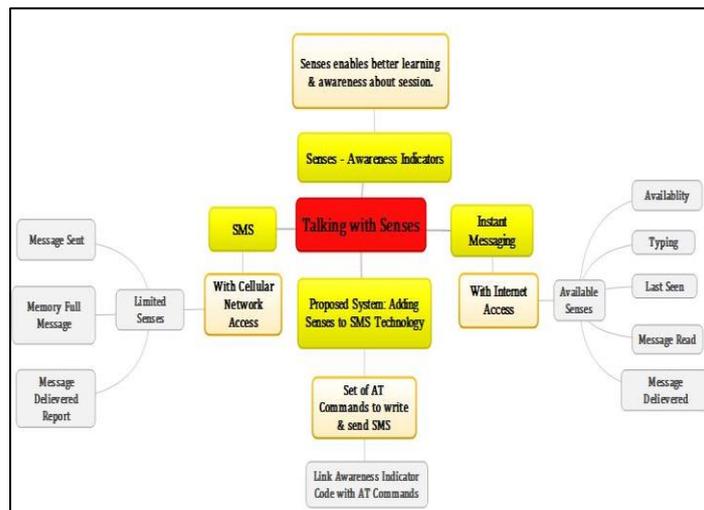*Keywords— Awareness Indicators, XMPP, AT Commands, GSM*

Fig 1. Mind Map for Proposed System

I.   INTRODUCTION

THE most interesting innovation in Instant Messaging services gaining popularity these days is use of 'Awareness Indicators'. Awareness Indicators is a set of attributes characterizing participation, interaction, structure of discussion or a collaborative session. They enable better learning and awareness regarding what is going on in the session or a conversation and provides summarized information about the discussion among the participants. These indicators reside between real life speeches with tone and pacing that is also kind of synchronous communication. But when we talk about our primary text messaging services SMS over cellular networks this facility of awareness about conversant is still not available without internet. What if a user sends a SMS and eagerly waits for reply from user at other end, then how is it possible to gather information about other participant like whether started typing a reply, available or not, has the message been read by receiver etc. To put senders anxiety and curiosity on hold for all such questions even when sender is not connected to internet it's very necessary to introduce some of these awareness indicators like typing alert, availability state, and message read state in SMS technology as well over cellular network.
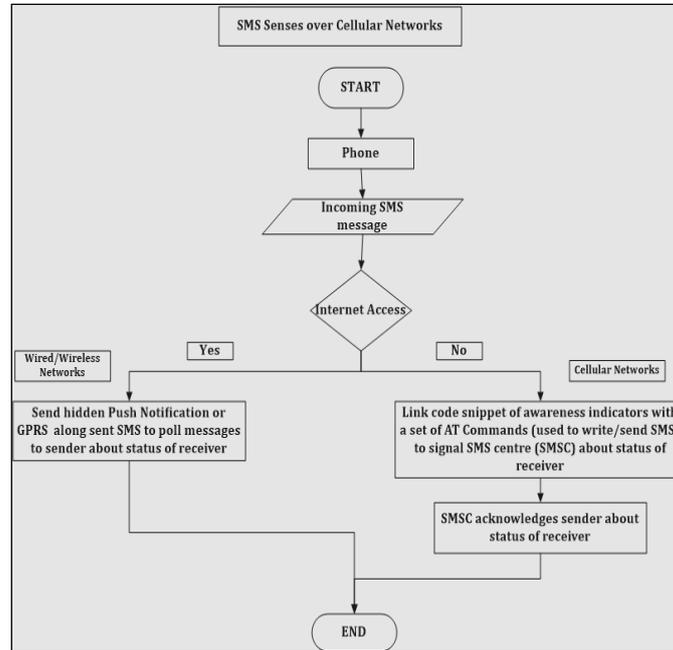

Fig 2. Flowchart for proposed system

These awareness indicators will not only help to gather information about the activities of conversant at other end but will also facilitate effective communication in 21st century the era where humans cannot imagine their life without internet.

II. SMS AND INSTANT MESSAGING

A. Short Messaging Services

Short Messaging Services [1] abbreviated as SMS is a global wireless service that enables the transmission of alphanumeric messages between mobile subscribers and external systems. It uses standard communications protocols which are a set of digital rules for data exchange that allows mobile phone devices to exchange short text messages.

SMS originated from radio telegraphy in radio memo pagers using standardized phone protocols that were defined as part of the Global System for Mobile Communications (GSM) standards for sending messages up to 160 characters to and from mobile handsets. Other mobile technologies, such as ANSI CDMA networks and Digital AMPS, as well as satellite and landline networks are also available.

B. Elements of GSM Network

The Short Message Center (SMC) [2] is an entity which store and forward messages to and from the mobile station. The Short Message Entity (SME) located in fixed network or a mobile station, receives and sends short messages.

The SMS GWMS (SMS gateway MSC) is a gateway that can receive short messages. The gateway MSC is a mobile network's point of contact with other networks. On receiving the short message from the short message center, GMSC uses the SS7 network to interrogate the current position of the mobile station from the HLR, the home location register. HLR is the main database in a mobile network. It holds information of the subscription profile of the mobile and also about the routing information for the

subscriber, i.e. the area (covered by a MSC) where the mobile is currently situated. The GMSC is thus able to pass on the message to the correct MSC.

Mobile Switching Center (MSC) is the entity in a GSM network which does the job of switching connections between mobile stations or between mobile stations and the fixed network.
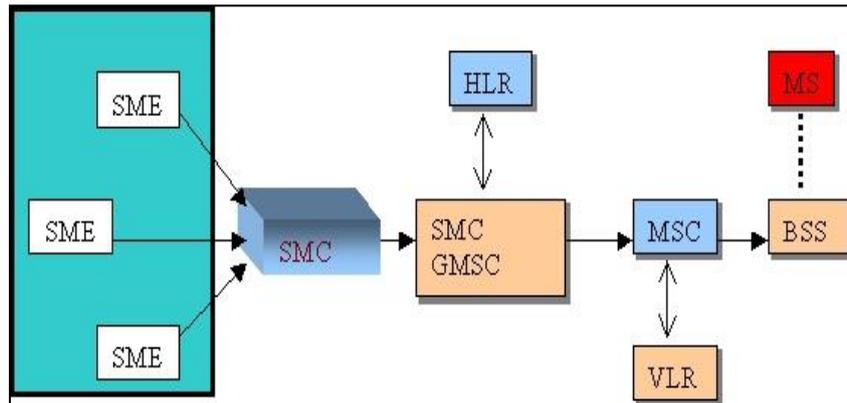

Fig.3. Organization of network elements in a GSM network supporting SMS [2]

A Visitor Location Register (VLR) [2] corresponds to each MSC and contains temporary information about the mobile, information like mobile identification and the cell (or a group of cells) where the mobile is currently situated. Using information from the VLR the MSC is able to switch the information (short message) to the corresponding BSS (Base Station System, BSC + BTSs), which transmits the short message to the mobile. The BSS consists of transceivers, which send and receive information over the air interface, to and from the mobile station. This information is passed over the signaling channels so the mobile can receive messages even if a voice or data call is going on.

III. SMS PROTOCOLS SERVICES AND FEATURES

A. SMS Protocol Services [28]

Short Messaging Services is a technology with two main basic services: Short Message Mobile Terminated (SM-MT) and Short Message Mobile Originated (SM-MO).
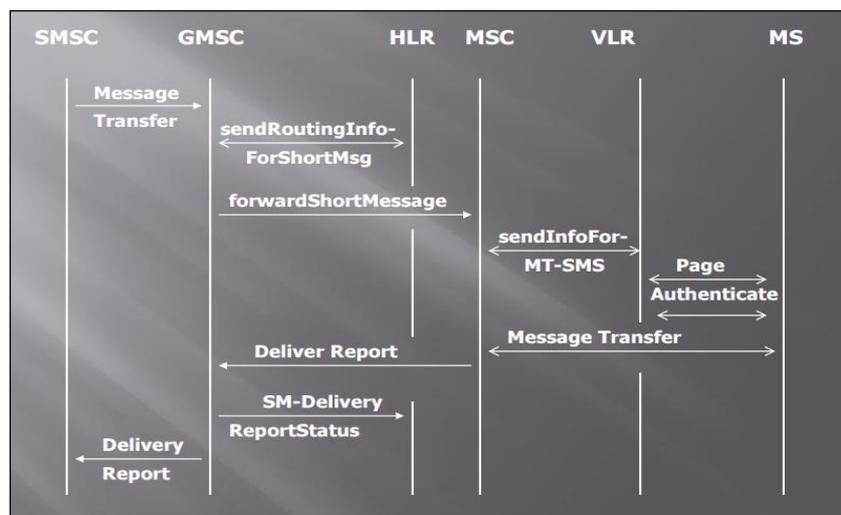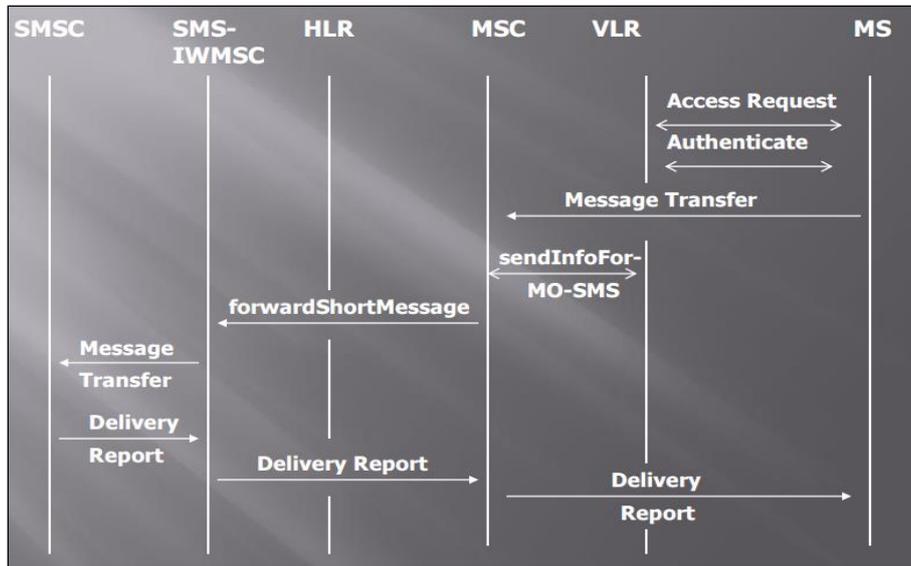

Fig. 4. Message Flow SM –MT [28]

Fig. 5. Message Flow SM –MO [28]

SMS allows message delivery to handsets using SMS submit, SMS Delivery concept. SMS messages are transported in core network using signaling system 7 (SS7).

B. SMS Services Elements [28]

- Validity Period
- Service Centre Timestamp
- Protocol Identifier
- Messages in Queue to Send
- Priority
- Message Waiting
- Alert Service centre

C. SMS Applications

1. Text Messaging
2. Quick and speedy provision of Information across sender and receiver.
3. Alerts and notification of information at sender's convenience.
4. Interactive and easy to use user interface for text messaging.
5. Facilitates downloading of image, contact information and other content.
6. Ease of information transfer at faster rates.
7. Always on connection support.
8. Supports broad applications transfer.

D. Concept of SMS Technology [28]

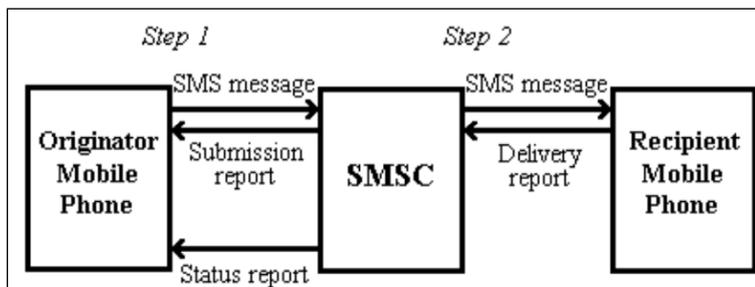   I.   SMS Center
  II.   Intra Operator SMS Messages

Fig. 6. SMS Technology for messages flow across sender-receiver [28]

E. SMS Gateway Protocols [28]

1. HTTPS/S API
2. SMTP
3. SMPP
4. XML
5. FTP
6. COM Object API.

IV. LIMITATIONS OF SMS: NEED ATTENTION

A. Limitations of SMS

SMS was originally used as two ways messaging among geographically distant entities over cellular network, intended to supersede capability of alphanumeric paging. With advancement in technology many newer implementations of SMS came into picture like Email, Fax, and Information services. The most popular being Internet Instant Messaging Services like Whatsapp, WeChat, Gtalk etc which has revolutionized the way we communicate connecting millions of people every day across a variety of platforms.

The recent advancement in these IM's services, driving popularity these days is use of 'Awareness Indicators' [4, 5] added to their existing functionality of messaging. They enable better learning and awareness regarding what is going on in the session and summarized information about the discussion among the participants. Some of the commonly used awareness indicator that is presently in use is availability state, typing state, last seen, message read, and delivery status. Awareness Indicators support the moderator in making his or her own judgments about the on-going conversation and deciding whether to intervene further.

B. Need of Awareness Indicators in SMS

The capability of awareness indicators to support moderator to intervene further can be extended to SMS services as well over cellular network. So that if a user sends SMS and eagerly waits for answer from the user then it is possible for sender to check if receiver has read the message, started typing the reply or not as well the availability state of receiver.

C. Availability Awareness Indicator: Presence Information

Presence information [4, 5] is a growing tool towards an effective and efficient communication. Presence information allows to instantly checking who is available in network, giving more flexibility to start up a conversation.

Fig.7. Presence Indicators [5]

This precise communication eliminates the inefficiency of phone tag or email messaging.

D. Protocol for Presence Information: XMPP

Extensible Messaging and Presence Protocol' ('XMPP') [6, 7, 9] is an information exchange procedure for message-oriented Middleware founded on XML (Extensible Markup Language). The procedure was initially designated 'Jabber', and was elaborated for close real-time, immediate electronic communication (IM), existence data, and interaction catalog upkeep.

E. Typing Awareness Indicator

A mere keystroke in instant message is a starter pistol that lets a participant know that other participant is typing a message. The chat client conveys this information that can even invoke anxiety and curiosity in participant at other end of conversation regarding the reply. This rendering of text message can be seen as we type in many different forms like ellipsis, typing keyword etc depending on type of IM service.
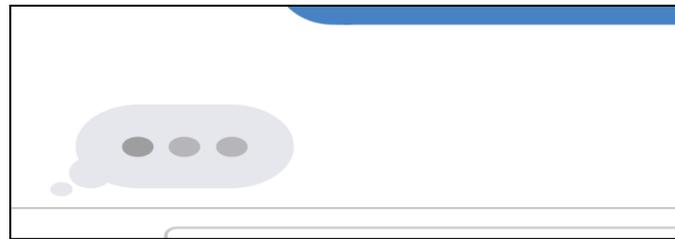
Fig.8. Typing Indicator [5, 9]

V. PROPOSED SYSTEM

AT [10] commands are instructions used to control a modem. AT is the abbreviation of ATtention. Every command line starts with "AT" or "at". Many of the commands that are used to control wired dial-up modems, such as ATD (Dial), ATA (Answer), ATH (Hook control) and ATO (Return to online data state), are also supported by GSM/GPRS (General packet radio service) modems and mobile phones.

The starting "AT" is the prefix that informs the modem about the start of a command line. It is not part of the AT command name.

A. AT commands

GSM/GPRS modems and mobile phones support an AT command set that is specific to the GSM technology, which includes SMS-related commands.

The following lists of AT commands are used to write and send SMS messages:

TABLE I
AT COMMANDS TO WRITE AND SEND SMS

AT command	Meaning
+CMGS	Send message
+CMSS	Send message from storage
+CMGW	Write message to memory
+CMGD	Delete message
+CMGC	Send command
+CMMS	More messages to send

AT commands with a GSM/GPRS MODEM or mobile phone can be used to access following information and services:

- Information and configuration pertaining to mobile device or MODEM and SIM card.
- SMS services.
- MMS services.
- Fax services.
- Data and Voice link over mobile network.

B. Demonstration of AT Commands on Falcom Test Software Terminal using SIGMA GSM Trainer Model – GSM 100 AT

Fig.9. Falcom Test Software (V8.0.07)/ Terminal

1. Read/Set CSCA command is used to read or set service centre number through which SMS messages are sent.
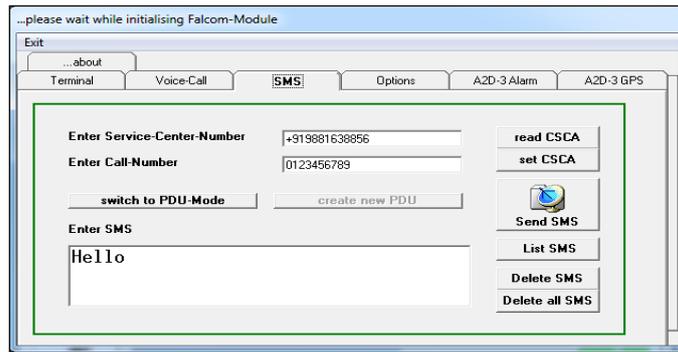

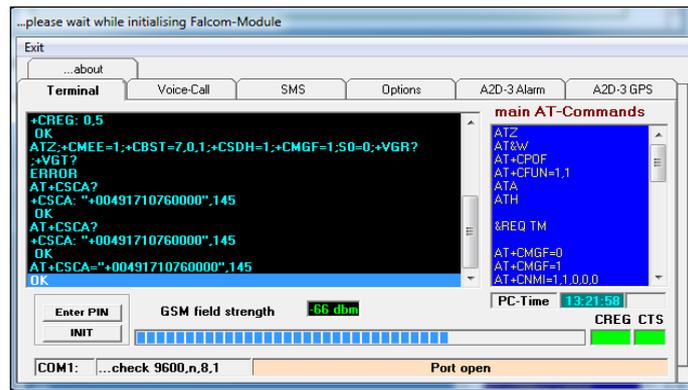Fig.10. SMS Tab of Falcom Module

Fig.11. CSCA Command to read/set service centre number

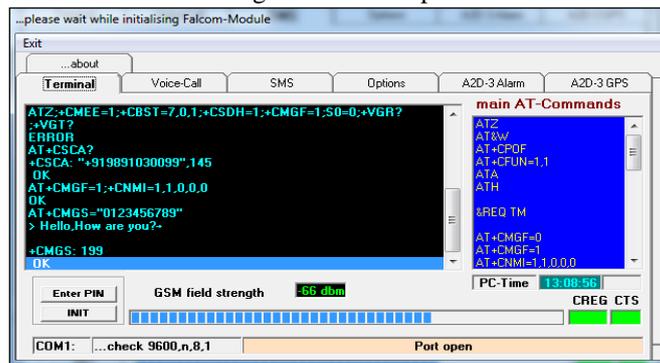2. AT+CMGS command is used to send SMS along with receiver phone number and message to send.
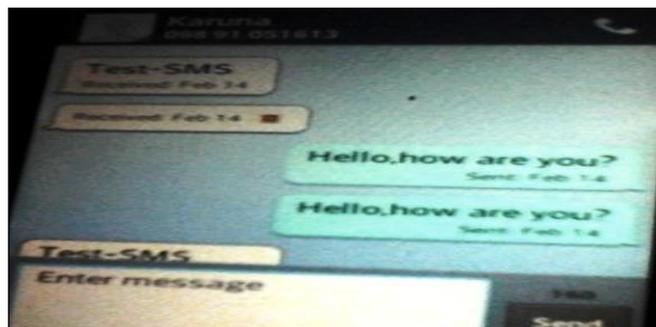

Fig.12. SMS Sent AT Command
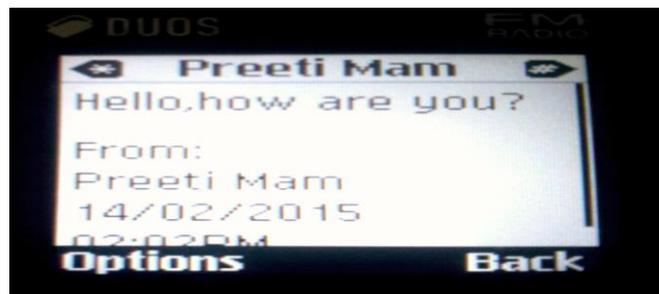

Fig.13. Message Sent status on Sender Phone

Fig.14. Message Received status on Receiver Phone

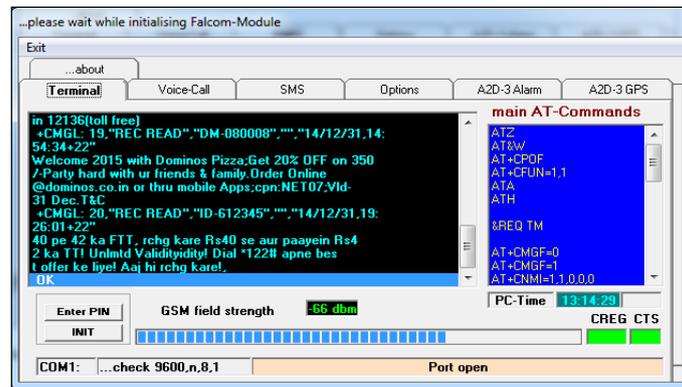3. AT+CMGR command is used to read SMS messages.

Fig.15. Listing of SMS Command

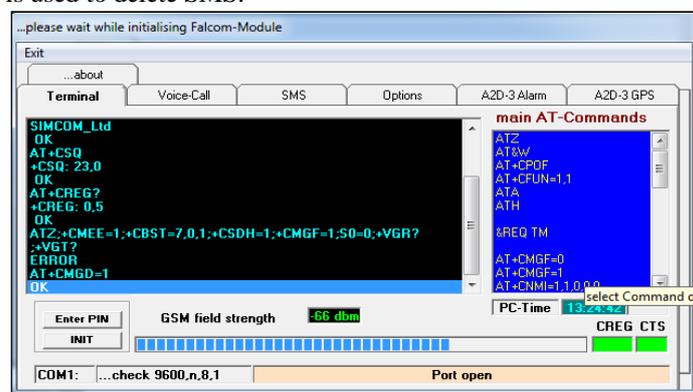4. AT+CMGD command is used to delete SMS.

Fig.16. SMS Deleted Command

5. AT+CNMI is new message indicator command and to get a delivery status report following set of commands can be used:-

AT+CMGF=1
AT+CSMP = 49, 167, 0,242
AT+CNMI = 1, 0,0,1,0
AT+CNMI = 2
AT+CMGS="PhoneNumber" to send SMS

We will get delivery status report from message centre in form:-

+CDS:6,72,"9851111111[PhoneNumber]",129[Message ID],"05/12/13,13:16:18+22"[TimeStamp],"08/11/17,10:16:21+22"
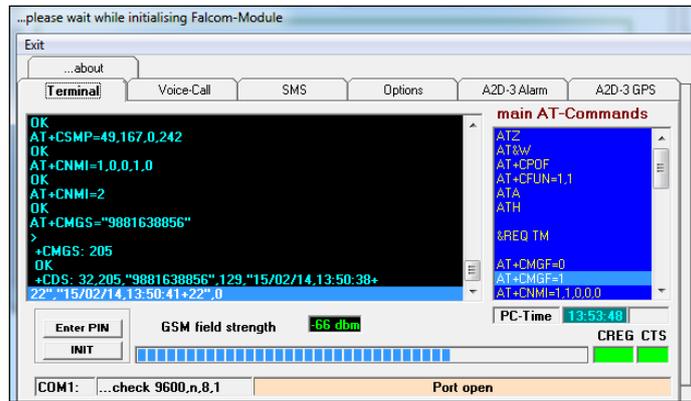**, 0[Error Code]**

Fig.17. Delivery Status Report from SMS Centre

6. AT Commands to signal when a new SMS received.

AT+CMGF=1 # Set message format to text mode
AT+CNMI=1, 1,0,1,0 # Set new message indicator
AT+CPMS="SM","SM","SM" #Set preferred message storage to SIM

+CMTI: "SM",0 # Message notification with index

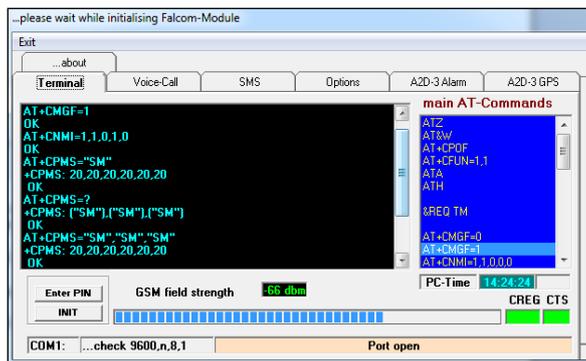AT+CMGL="REC UNREAD" # Retrieve unread Messages.

Fig.18. Commands to signal new SMS arrival

C. Proposed Solution: Add Awareness Indicator in SMS

Scenario: If a user sends SMS and eagerly waits for answer from user then is it possible for sender to check if receiver has read the message and started typing the reply or not as well the availability state of receiver.

A possible solution is by linking the code snippet of awareness indicator already in use for Instant Messaging with set of AT commands used to send-write SMS. Thus one can make judgment about the ongoing conversation & gain awareness about the availability of other participant and can decide whether to intervene further.
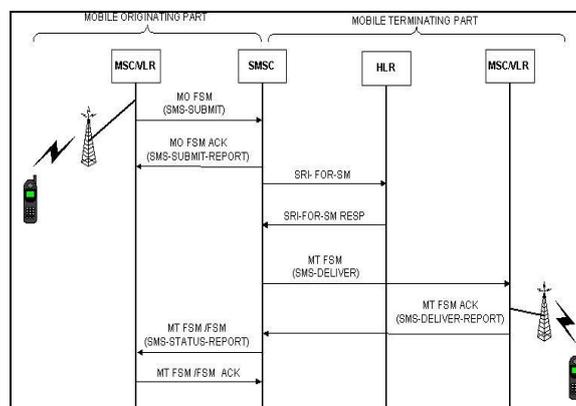

Fig.19. Basic end to end SMS call flow [20]

A possible solution to acknowledge receiver's 'SMS read state' is to have a set of AT commands that signals SMS centre (SMSC) about opening of unread message. Actually SMSC [21] is responsible for reception of SMS from wireless network users, storage of text messages, forwarding of text messages, delivery of SMS to wireless network users, Maintenance of unique time stamps in text messages. It also notifies sender of status report about the delivery of SMS in form of SMS only if sender requests for status report.

On same ground a combination of a set of AT Commands can be used to signal SMSC about opening of an unread message by receiver. This can be used to acknowledge sender about message read status of recipient.

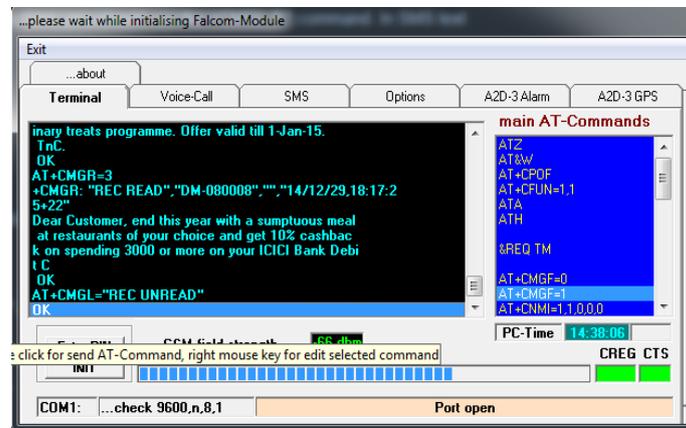AT+CMGL="REC UNREAD" is the AT Command used to retrieve unread messages.

Fig.20. Command to Read Unread Messages

D. Advantages of Proposed System

- Reduces stress, anxiety, waiting time for reply.
- Reduces burden of remembering login credentials to login in to internet.
- No need to pay extra for monthly/periodic Data Card Recharge.
- SMS is one of the reliable, low-cost communication mechanisms.
- SMS economical use of the control and traffic channels saves the network from congestion.

SMS over cellular network is within reach of every other user and its ease of use is at finger tips of every user.

VI. RELATED WORK

AT [16] commands are also known as Hayes [18] AT commands. A Hayes Microcomputer Products, where it was invented, AT was merely short for "ATtention". They allow giving instructions to both mobile devices and ordinary landline telephones.

Awareness Indicators [4, 22] are set of attributes characterizing terms of participation, interaction, structure of a discussion or collaborative session. These awareness indicators are very useful in context they give sender a feeling of sense [19] of ease especially in case of emergency or urgency when a response is expected from recipient. In such cases it is mandatory not to have dependency on internet access and the process of sending message instantly should be feasible using SMS service over a simple cellular network.

Presence information [5, 26] is a status indicator that conveys ability and willingness of a potential communication of a participant. A user provides presence state via a network connection to a network service which accepts stores and distributes presence information, and can be made available for distribution to other users called watchers to convey his availability for communication.

VII. CONCLUSION

Making machines merely just talk with each other without any senses may not be a very promising way of effective communication in today's era. Adding Senses to machine will enable better learning and awareness regarding what is going on in a conversation between machines. These senses are already available in form of Awareness Indicators in Instant Messaging Services available over Internet. But when it comes to SMS over cellular networks we miss these senses/indicators. So adding these indicators in SMS services as well will revolutionize the way of communication over cellular network without the need of internet.

VIII. FUTURE WORK

Concept of SMS delivery acknowledgment already exists on similar grounds a push notification that is automatically invoked along with SMS delivered at receiver's end in order to get SMS opened acknowledgment. Since SMS services some sort of human intervention is required from receiver's end to acknowledge service provider to gain an insight about receiver's action for the sent SMS. The proposed system can also be extended to incase of internet connection what modifications need to be taken care of by service provider. A smart and intelligent search engine with capability of automatically detecting and providing related search results from owner's contact list as and when user types in phone search menu. This capability can be extended for non smart phone mobile handsets. We can also include feature of group conversation in SMS like it is in IM's to enhance its flexibility.

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Available: http://memberfiles.freewebs.com/46/92/89279246/documents/MOBILE%20COMPUTING.pdf