



SMS Based M-Learning System for the Underprivileged Children in Developing Nations

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Abstract: United nations have defined Internet as a human right as it enables us to effectively share ideas. Even though it has revolutionized the way we live, access to it is dependent on socio economic factors, as many in the developing nations simply cannot afford to own a computer.

The paper proposes 'TextNet' system which enables people to access Internet through SMS Technology. The proposed system provides offline access to information available over Internet and works solely on the SMS (Short Message Service). A user simply needs to send a request for information about any topic to a designated number, which is received at server and after fetching information from Internet; the server sends it back to user through SMS

Keywords: Short Message Services (SMS), Mobile Learning (M-Learning), Mobile Learning Tool (MOLT)

1. INTRODUCTION

Mobile phones have completely revolutionized our world and have become important part of our lives. Before mobile phones, communication was dependent on wired mediums but now we can communicate at any place using mobile phones. Mobile phones are generally sub-divided into two categories i.e. feature phone and smart phone. Smart phones are becoming popular however due to the relatively higher cost these are out of reach for many in the developing nations. Both types of phone can be used for calling and texting while smart phones offer additional features such as installing apps. This research aims to enable the underprivileged who cannot afford a smart phone to access the Internet with the help of SMS/text messages.

The rest of the paper is organized as follows: section 2 contains the background and related research work, section 3 describes the design and implementation of the proposed systems.

2. MOBILE LEARNING SYSTEMS

(Nadire and Ibrahim 2009) propose system named as Mobile Learning Tool (MOLT) which supports users in learning new technical English words using Short Message Service (SMS) texting. This system is just only limited to teaching of new vocabulary but results showed that students enjoyed learning in this way (Cavus *et al*, 2009).

(Lominé, and Buckingham 2009) in their research paper discusses about the opportunities to use Short Message Service (SMS) in educational context particularly in teaching and learning. They also

answered questions relating to use of SMS in educational context to clarify people views about it (Lominé *et al*, 2009).

The research paper having title 'Leveraging SMS Infrastructure for Internet Access in Developing Countries: Scenarios, Architecture and Research Directions' also published in 2011 which depicts the internet availability issues in developing countries referring to statistics that only limited number of people in such countries are having internet access. Due to this problem e-services cannot be deployed at wider level as access to internet is must to use them. It also presents an architecture which uses SMS at backend to access e-services though it is comparably slow but available anywhere and anytime (Belqasmi *et al*, 2011).

A project named as Wikipedia Zero was also launched by Wikimedia Foundation in collaboration with telecom companies to provide Wikipedia free of cost on mobile phones in developing countries. Though there are no charges to use this service but it still required a high speed data connection by telecom operator. Which is a major problem in underdeveloped parts of the world where users can access internet using data plans in some specific cities only thus ignoring rural population (Wikipedia Foundation, 2016)

The last decade has seen an enormous growth in usage of mobile phones in the developing world, thus connecting millions of unlinked people. The ubiquity of mobile phones like short message service (SMS) provides new exciting opportunities in educational context.

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(Jones, and Reid 2009) found that majority of students have mobile phones and they frequently check it for any incoming messages. Hence it is very useful in immediate capturing of user's attention (Jones *et al*, 2009). Text messaging is also very beneficial as mobile devices are always turned on and most of it's owners are students (Shih and Mills 2007). Furthermore, instant messaging requires signing in and an internet connection but this is not the case with SMS as it is not dependent of internet (Jones, 2009).

Many researches have been done in this area and researchers believe that there is need for further exploration in education. The possible areas of investigation include classroom discussions (Bollen *et al*, 2004), two-way service interactions, text based games (Stone *et al*, 2002), vocabulary teaching (Thornton *et al*, 2004), and learning support (Mitchel *et al*, 2003).

3 DESIGN AND IMPLEMENTATION

TextNet system is basically composed of two different components and each of these components combine to form a system named TextNet. The system includes an Android application for user interaction and a Server that receives SMS requests and responds.

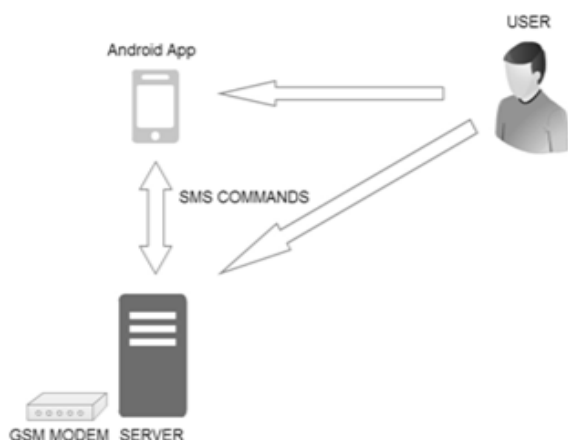


Fig. 1: Architectural Diagram

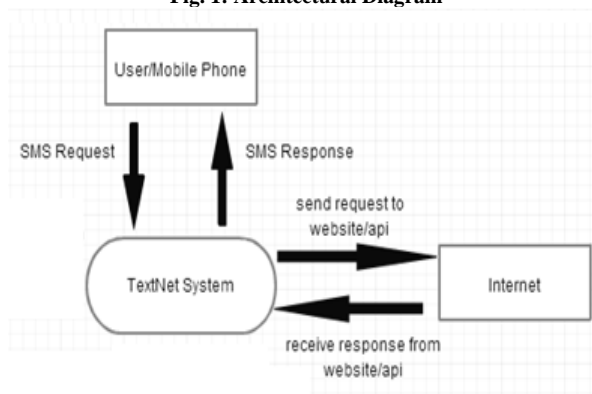


Fig. 2: Context Diagram

3.1 Working

User sends a SMS request by using TextNet Android application or manually to server. On the basis of request, Server fetches desired information from internet and sends back response through SMS to user phone.

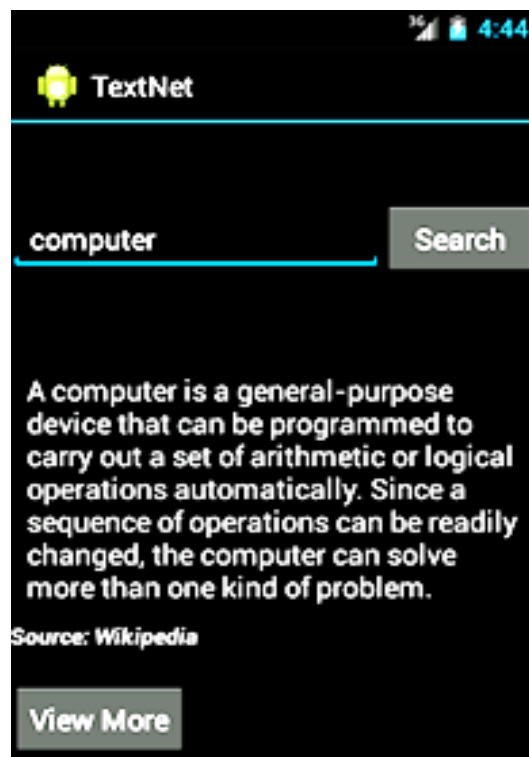


Fig. 3: TextNet screen showing result from Wikipedia

4. METHODOLOGY

Currently our focus is only on Wikipedia feature of TextNet System to discuss the methodology. Other features will be implemented in the same way.

4.1 Android application

4.1.1 Sending SMS

This module is to send a SMS to server when user requests for some information from server by interacting and inputting parameters to application. A service is developed in Android that runs at the background and sends SMS to server without letting the user know that a SMS is sent at backend and appears transparent to user as if application is directly fetching data from some internet connection.

The mobile number to which SMS will be send is actually the server's number on which it will receive SMS requests. This number always remains same and thus hardcoded in our application.

```

Private voids end SMS Message(String phone No,
String message) {try {Sms Manager sms Manager =
Sms Manager. Get Default();
Sms Manager. Send Text Message(phone No, null,
message, null, null);
Toast. make Text (get Application Context(),
"SMS sent.", Toast. LENGTH_LONG).show();
} catch (Exception e) {
Toast. Make Text(get Application Context(),"SMS
failed, please try again.", Toast.
LENGTH_LONG).show();
e. prints tack Trace();
}
}
}

```

4.1.2 Receiving SMS

This module is responsible for receiving of SMS response from a server and forwarding the data to the activity that requested it.

```

Public void on Receive(Context context, Intent
intent) {
Bundle bundle = intent. Get Extras ();
Sms Message[] msgs = null;
String str = "";
String sender="";
if (bundle != null){
//---retrieve the SMS message received-
--
Object[] pdus = (Object[]) bundle.
get("pdus");
msgs = newSms Message[pdus. length];
for (inti=0; i<msgs. length; i++){
msgs[i] = SmsMessage. Create From
Pdu((byte[])pdus[i]);
sender = msgs[i].get Originating
Address();
str += msgs [i].getMess age Body().to
String();
}
}
}

```

After receiving SMS it is checked that it is sent by server using a hardcoded server's number. If it is from server than it is further processed and forwarded to particular activity and its further broadcast is aborted using abort Broadcast() method. If the sender is not server than nothing is done and it will be received by the second highest priority application which is usually default SMS application in Android.

4.1.3 Getting Article from Wikipedia

This module requires one input from the user which is a title for which article is desired. When user clicks on Find Article button a request is sent automatically to the server using a predefined format sending title in request. After that it waits for response from user and when received the response is shown to the user.

```

Intent i = new Intent(get Base Context(), Sms
Service. class);
String query = "wikipedia_request:"+article
NameET.get Text();
i. putExtra("message", query);start
Service(i);

```

4.2 Server

4.2.1 Receiving and Sending SMS

The Server receives and sends SMS by means of a USB GSM Modem device connected to the server computer on USB port. We have used SMSLib library for sending and receiving SMS via GSM modems which at the backend uses AT commands to communicate with GSM Modem.

The code snippets for this module are shown below.

```

Serial Modem Gateway gateway = new Serial Modem Gateway
("modem.com7", "COM7", 921600, "ZTE", "MF636");
//setting storage location to modem memory
AATH andler handler = gateway. Get ATH andler();
handler. setStorageLocations("ME");
gateway. setProtocol(Protocols.PDU);
gateway. setInbound(true);
gateway. setOutbound(true);
gateway. setSimPin("0000");
gateway. setSmsc Number ("923189244444");
Inbound Notification inbound Notification = new Inbound
Notification();
Outbound Notification outboundNotification = new Outbound
Notification();
Service.getInstance().setInboundMessageNotification(inboundNo
tification);
Service.getInstance().setOutboundMessageNotification(outbound
Notification);
Service. getInstance().add Gateway(gateway);
Service. getInstance().start Service();

```

```

public class Outbound Notification implements IOutbound
Message Notification{
public void process(A Gateway gateway, Outbound
Messagemsg){
System. out.println ("Outbound handler called from
Gateway: " + gateway.get GatewayId());
System.out. println(msg);
}
}

```

```

public class Inbound Notification implements IInbound
Message Notification{
public void process(AGateway gateway, Message
Typesmsg Type, final Inbound Messagemsg){
if (msgType == Message Types. INBOUND) {
System. out. Println (msg);
try {
//processing request and sending response as shown
below
}
}
}
}

```

When a new Inbound Message Notification occurs the SMS is read from GSM Modem. The SMS is then processed and on the basis of request other modules are used to fetch desired information from internet and response is sent back to the requesting number by passing Outbound Message object to send Message() method of Service instance. This is shown in following code snippet.

```

If (msg. get Text().starts With("sports_request")){
    new Thread(){public void run() {try {
        String response = "sports:"+Sports News.get();
        String sender = msg.get Originator ();
        Outbound Message msg1 = new Outbound
        Message(sender, response);
        Service. getInstance().sendMessage(msg1);
        System.out.println(msg1);
    } catch (Exception ex) {ex.printStackTrace();
    }
    }
    }.start();
}

```

4.2.2 Fetching Wikipedia Articles

This module when called by main Server program fetches the article using Wikipedia API provided that title of article is given. The API returns a XML document that is parsed using DOM parser. The parsed information is then returned to the calling Server program from where it is send to user in response through SMS. The code snippet for this module is shown below:

```

String url =
"http://en.wikipedia.org/w/api.php?action=query&prop=ex
tracts&format=xml&exsentences=3&explaintext&redire
cts&continue=&title="+title;
Document Builder Factory dbFactory = Document Builder
Factory. New Instance();
Document Builder dBuilder = dbFactory. New Document
Builder();
Document doc = dBuilder. Parse (new URL
(url).openStream());
doc. getDocument Element().normalize();
NodeList nodes = doc.getElements ByTag Name ("page");
for (inti = 0; i<nodes.getLength(); i++) {
    Node node = nodes.item(i);
    if (node.getNodeType() == Node.ELEMENT_NODE) {
        Element element = (Element) node;
        article += getValue("extract", element).replace
        All("<.*?>", "");
    }
}

```

5 CONCLUSION

This paper proposed the TextNet system which enables a user to access the Web for learning purposes by using SMS technology. The user can access sites like Wikipedia by sending sms to a given number which is forwarded to a webserver which processes the request and return the result in the form of a text message. The proposed project proposed above is just a prototype and requires a SMS Gateway before it can be released commercially. A SMS gateway typically sits between the end user who needs to send/receive SMS and a mobile network's SMSC and provides a much faster means of communicating with the user.

The project has resulted in several possible challenges for the future work some of these are listed below:

Evaluating the TextNet System

Using SMS gateway to improve performance times

Speech driven services

Addition of new learning features from different encyclopedias, dictionaries available over Internet.

Using MMS facility to have multimedia responses from Server.

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