European Journal of Scientific Research
ISSN 1450-216X Vol.60 No.2 (2011), pp. 295-304

http://www.eurojournals.com/ejsr.htm

Online Mobile Phone Recharge System in Nigeria

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Abstract

An e-portal system that allows mobile phone users to recharge their phones online without necessary purchasing any recharge card is proposed. With this e-portal system, users simply provide the amount to be loaded on the specified phone number and some series of validation are performed before finally recharging the phone with the specified amount. This e-portal system also eliminates the burden of generating random numbers as recharge cards and the subsequent huge database accompanied with the storage of these randomly generated numbers. Mobile service providers are still faced with the challenges of inefficient bandwidth utilization and congestion in the transmission channel. One of the main reasons for this congestion is the toll placed on the network by the need to reload/recharge phone credits in order to enable calls. The solution proposed in this paper is meant to improve bandwidth utilization by taking the process of recharging off the mobile clients.

Keywords: 2G/3G Mobile phones, Online Recharge, E-portal System, Mobile Banking

1. Introduction

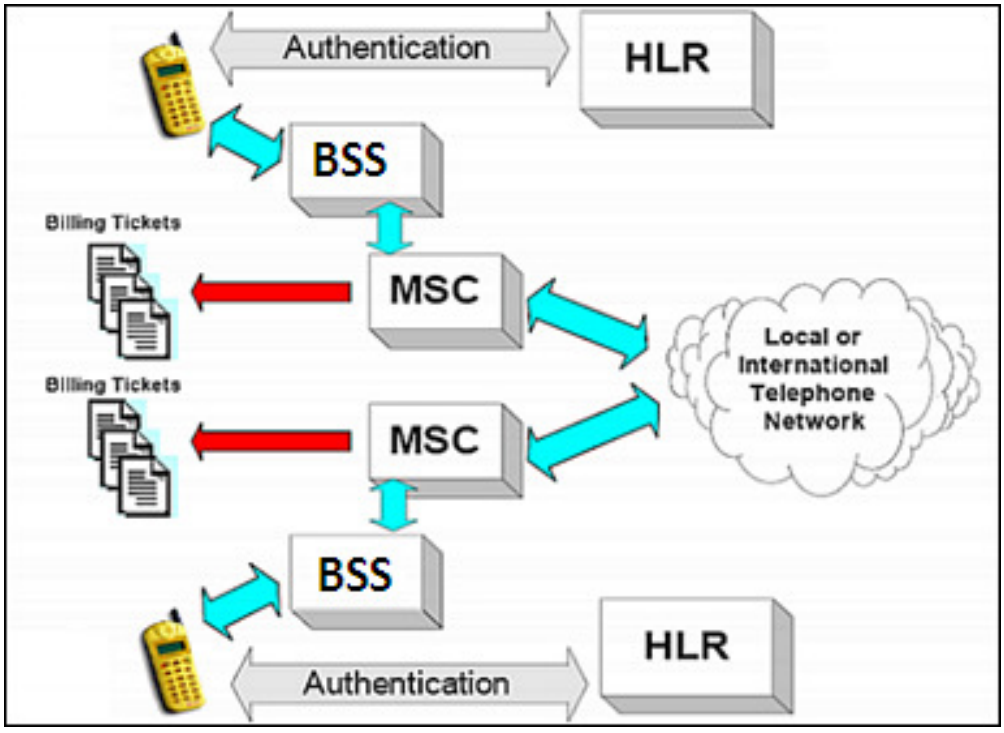
The Global System for Mobile (GSM) was first introduced in 1992 with approximately 23 million subscribers, rising to over 200 million in 1999 on over 300 GSM networks. The aim was to provide a global mobile telephone network that could be implemented using standard building blocks not tied to specific hardware vendors. The uptake of GSM by subscribers is far higher than any industry predictions and typifies the increasing need for personal mobility. The 1st generation GSM mobile telephone networks provide subscribers with high quality voice communications and low bandwidth (9.6Kb/sec) data connections for FAX, Short Message Service (SMS) and full dial-in connection to the Internet for email and web browsing, usually requiring a mobile computer or intelligent handset. The addition of overlay communication protocols, such as Wireless Application Protocol (WAP), allow mobile handsets on 1st Generation networks to be used for secure connection applications such as mobile banking and other transaction based services.

International roaming agreements between the numerous mobile telephone network providers allow subscribers to be reachable almost anywhere in the world where there is GSM coverage using the same telephone number and handset. Satellite based services allow GSM subscribers to further expand their network coverage and availability using the same mobile communications infrastructure. The

increasing use of mobile telephones and devices for data communication drives the need from the market for a fast, reliable and available infrastructure. GSM proposes to provide the required infrastructure using 2nd and 3rd generation Systems which introduce new technology that allows increased data bandwidths and new data services. 2nd generation system introduces the General Packet Radio Service (GPRS) and 3rd generation introduces the Universal Mobile Telecommunication System (UMTS).

In order to charge for mobile telephony services the network operator has to first capture the network usage of all of the network's users including subscribers and roaming subscribers. This usage data then needs to be processed and then set against the billing and charging models and tariffs in use. The Mobile Switching Centers (MSC) in the Operational Network (ON) produces the billing tickets for all the calls made in the mobile network. Figure 1 below describes the call-flow for mobile to mobile calls and billing ticket generation in a typical 1st Generation mobile telephone network. The MSCs produced billing tickets need to be collected and then processed centrally so that the subscriber bills can be produced.

Figure 1: Call Flow in First Generation System



The Home Location Registers are responsible for authentication of subscribers within the mobile network. The collection of billing tickets is often done by a mediation system. These systems may also carry out vendor specific translations on the billing ticket formats so that multi-vendor ONs can be implemented, or to allow the native billing tickets to be used on commercial billing system, or on other centralized OSS systems used for data-mining.

There are many charging models that have been proposed for the current and future Internet as well as those traditionally employed by the mobile and fixed line telephone networks. Most, if not all, of the Internet charging models are equally applicable for use in the mobile telephone networks, especially with the introduction of 2nd and 3rd generation systems. Some of the various types of charging models include the following: Metered Charging, Fixed Price Charging, Packet Charging, Expected Capacity Charging, Paris-Metro Charging [1] etc.

2. Literature Review

The need for information anywhere and anytime has been a driving force for the increasing growth and adoption of wireless communication. Advances in computing and communication technologies have contributed in no small measure to facilitate this. Mobile computing thus appeared as the merger of the two technological drives with the aim of providing ubiquitous computing environment for mobile users [2-5]. Networks today are becoming continuously complex, with increasing demand on bandwidth, one of the aims of this project is to remove the burden of recharging from the available bandwidth. GSM is the most widely used mobile network in the world dating back to more than a decade ago [4]. Amongst its objectives are the provision of good speech quality; low terminal and service cost; support for international roaming; support for handheld terminals; different range of services and facilities; spectral efficiency and ISDN compatibility. Currently, mobile phone networks are increasingly used for much more than voice calls. This is sequel to the improved capabilities of different handsets coupled with the increased data transfer rate [6]. As a result of these service improvements, mobile handsets can offer access to email, SMS, GPS, IM, MMS and WAP (Wireless Application Protocol) based on increasing technological advancement in their operations.

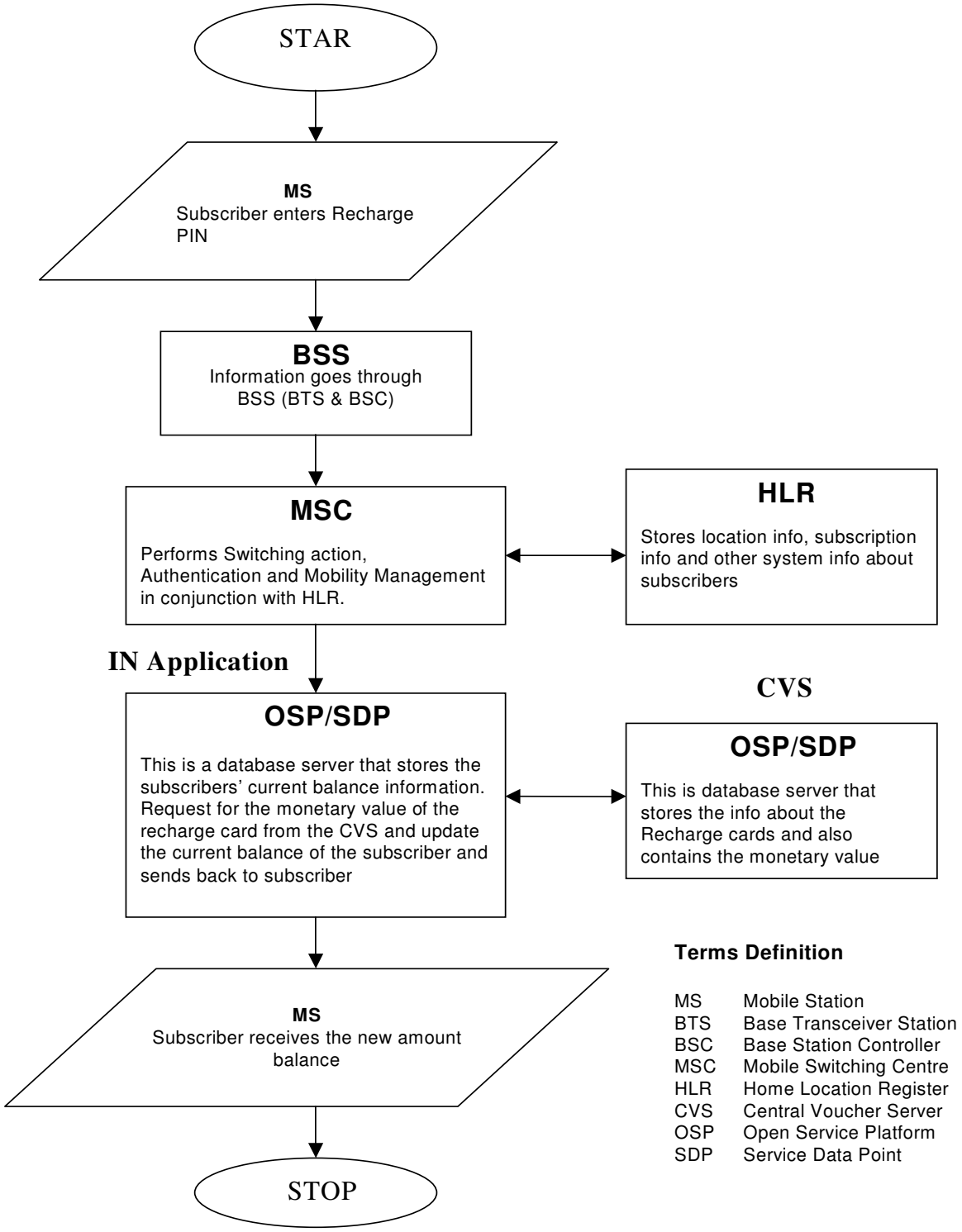
The sporadic growth in the acceptability of the GSM services has however led to the need to address the ever-growing complexity in the management of Mobile networks. Consequently, decentralized approaches to network services management is critically becoming evident due to the fact that centralized solutions has failed to successfully cope with scalability issues [6]. In a bid to avoid information overload and epileptic service rendition to the users, distributed intelligence approach to telecommunication management is currently being considered with this solution proposed to handle the recharge system for the network.

3. Mobile Recharge System Model

The flow chart in Figure 2 gives the process flow for the recharging of mobile phones in a typical GSM network. The subscriber buys the recharge card, scratches it and enters the recharge number into the mobile and then sends to the network. The information goes to the network through the BSS (BTS and BSC) to the MSC. The MSC in conjunction with the HLR performs the authentication and other location related functions. After the authentication process the information is sent to the IN application.

The IN has a database server that stores the subscribers' current balance information and requests for the monetary value of the recharge card from the Central Voucher Server (CVS) and update the current balance of the subscriber and sends back to subscriber. Then the subscriber receives the new current balance on his/her mobile phone.

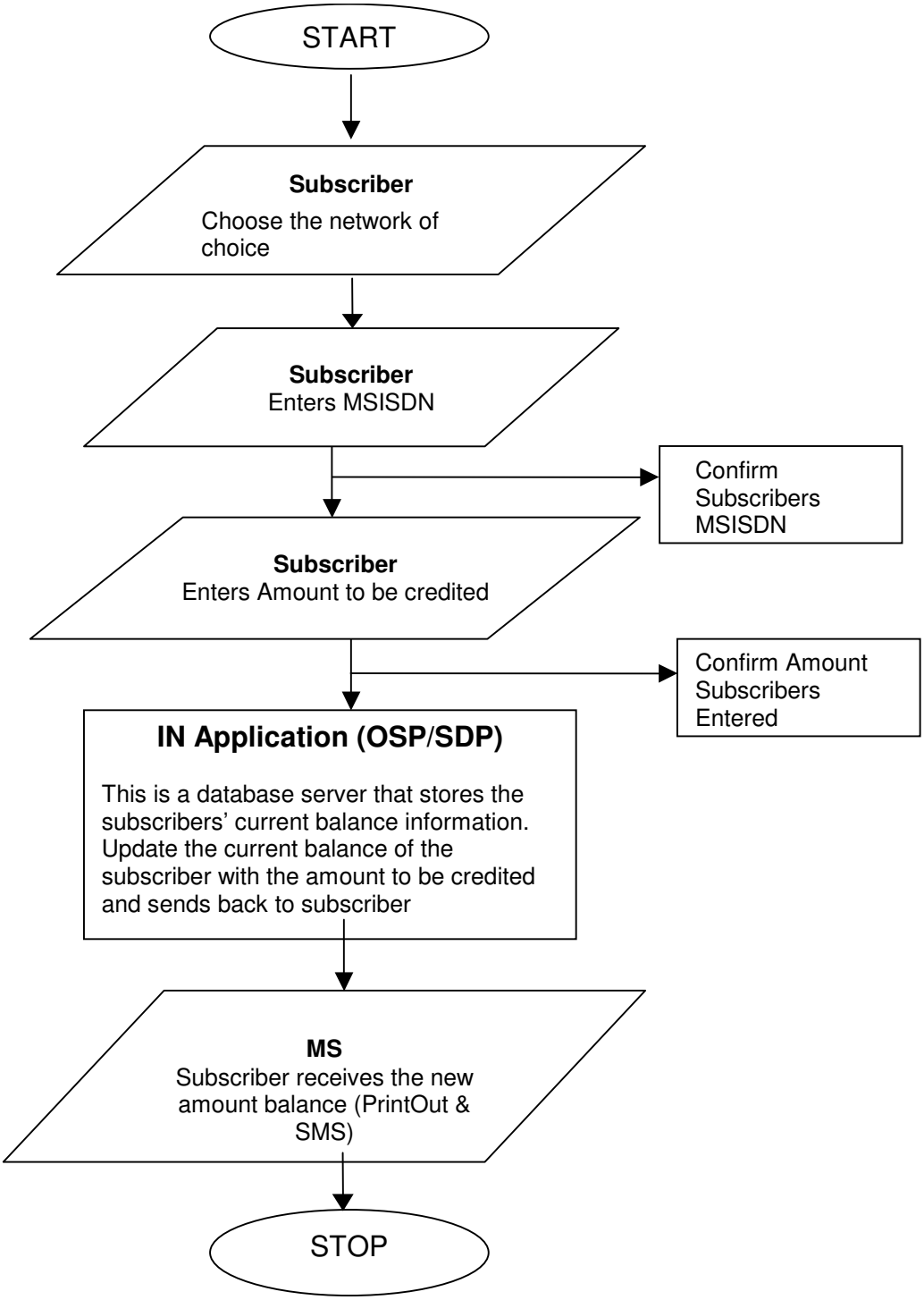
Figure 2: Existing Flow Chart for Recharge System



4. Project Methodology and Result

The flow chart in Figure 3 shows the proposed online recharge system where the Central Voucher Server is eliminated from the recharge flow chart. This reduces the burden on the already limited bandwidth and also prevent the extra cost of recharge card production and the burden of randomly generate numbers and the consequent huge database for the vouchers.

Figure 3: Flow Chart for the Proposed Online Recharge System



The online recharge system was implemented on a public IP address of **216.18.23.176.** This means it can be accessed anywhere there is internet connectivity. The online recharge package resides on https://216.18.23.176/ecard/etrack/index.php. The home page for the online system and other relevant interfaces are shown in Figures 4 to 9 below and it presents all the available networks in the country from which users can choose the desired network of choice.

System Algorithm

Step 1
Users choose the network of their choice from the various available networks and then enter the MSISDN to be credited. After the MSISDN is entered there is an authentication to verify the MSISDN.

Step 2
After the MSISDN is verified, then the user entered the amount to be recharged, again the amount entered is verified to be a valid amount.

Step 3
After MSISDN verification and the amount verification, the IN application which stores the subscribers' current balance information is updated with the amount to be recharged.

Step 4
After the IN application has updated the subscribers balance information, then an SMS is sent to the subscriber indicating the current balance, also a print out can be made for the transaction.

Figure 4: Home page for the Online Recharge System

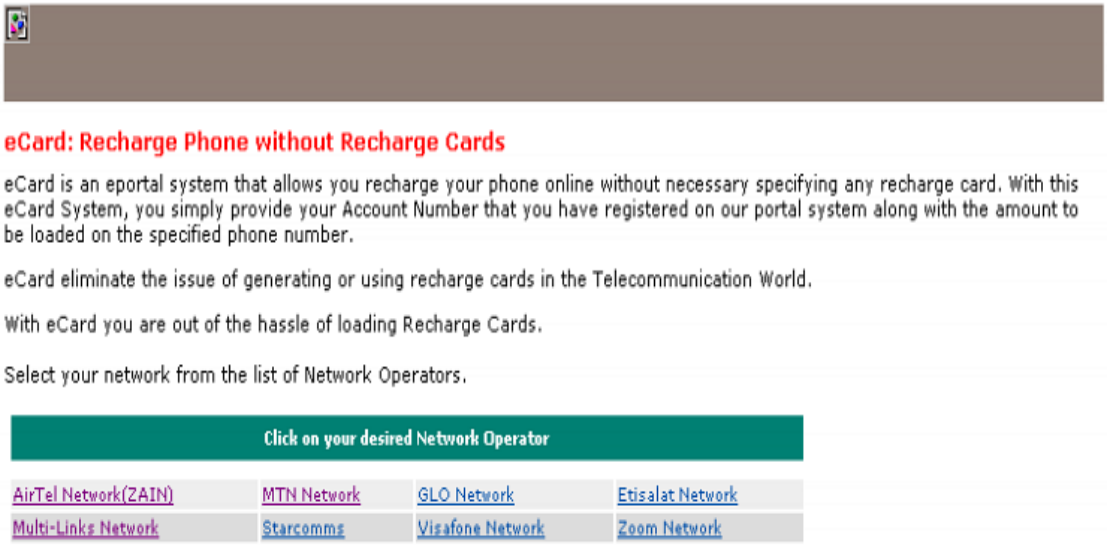


Figure 5: Page to enter phone number and amount to be credited

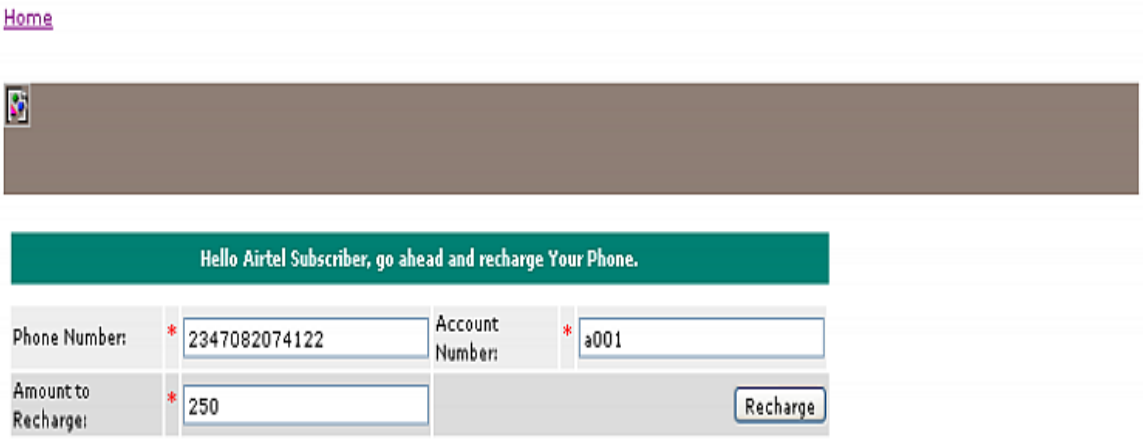


Figure 6: Confirmation message before the phone number is credited

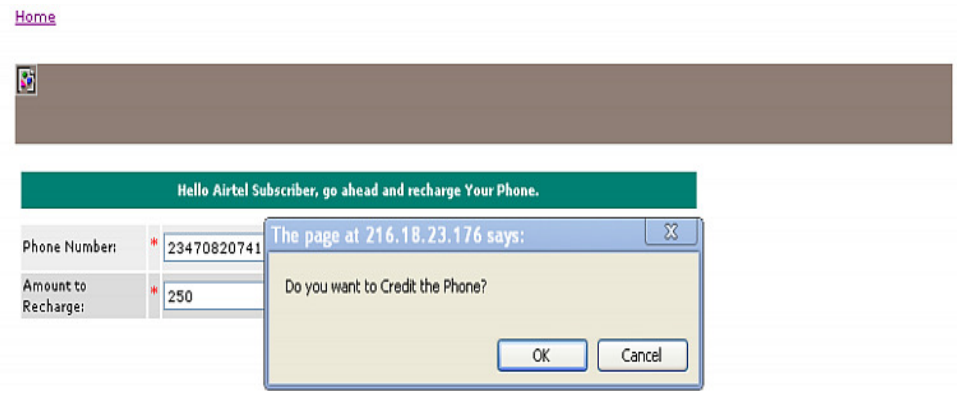


Figure 7: Message informing the user that the phone number has been credited

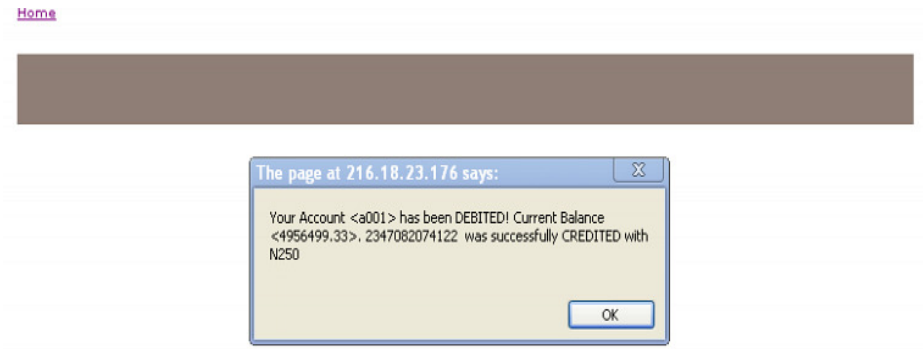


Figure 8: Print out Option for transaction details

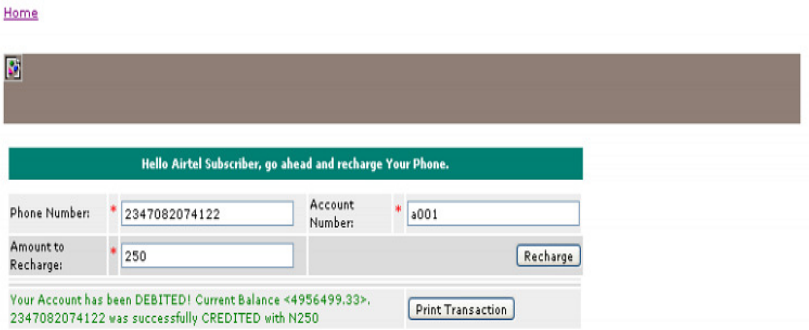
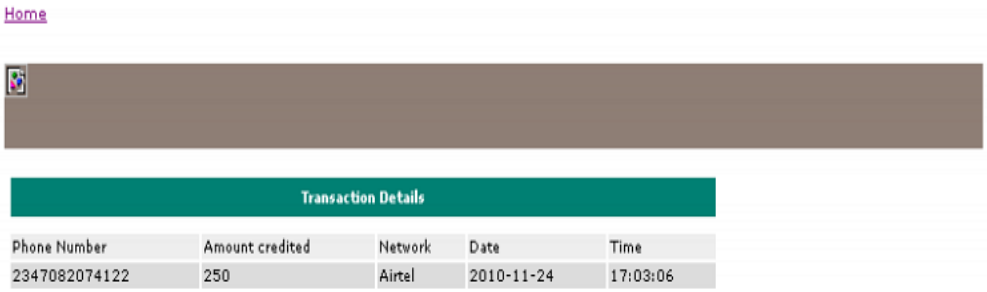


Figure 9: Print out of the transaction details.



As earlier mentioned, the proposed online recharge system would save on the limited network bandwidth used for the normal card recharging. Recharge is now done online via the internet and will eradicate the use of recharge card thereby saving the production cost for these recharge cards. The burden of generating random numbers and the consequent huge database Central Voucher Server is

avoided by this new online recharge system. With this proposed system, any amount of recharge can be made or demanded for, there is no restrictions on a particular amount of credits as experienced with the present recharge card system.

5. Conclusion

The online recharge solution system can also be improved and made operational by integrating it with the network operators' users and central voucher servers directly. Further work in this area include the mathematical modeling of the various charging models on simulated mobile network data, covering both voice and Internet data services. The future work will include the examining of combined charging models and the resultant effect on the income of the Mobile network providers. The cost impact on different types of subscribers using the mobile networks will also be investigated. There will always be a trade-off between the complexity of the billing system to be implemented and supported and the advantage the network provider will receive for having the systems in place. Fixed price charging schemes reduce the overhead of the charging and billing systems infrastructure, as they tend to provide the simplest charging scenarios. Usage based charging models provide incremental and harder to predict income for the network providers as well as requiring high investment in the charging and billing infrastructure required. This includes increased cost in network traffic involved in the collection of the billing data required.

References

[1] A. Odlyzko., "Paris Metro Pricing: The Minimalist Differentiated Services Solution", AT&T Laboratories Research, April 1999.

[2] G. Brasche, B. Walke., "Concepts, Services, and Protocols of the New GSM Phase 2+ General Packet Radio Service", IEEE Comms Magazine, August 1997, pp 94-104.

[3] J. Cai and D.J. Goodman, "General Packet Radio Service in GSM", IEEE Comms. Magazine, October 1997, pp 122-130.

[4] D. Clark, "A Model for Cost Allocation and Pricing in the Internet", MIT Workshop on Internet Economics, March 1995.

[5] S. Shenker, D. Clark, D. Estrin, S. Herzog., "Pricing in Computer Networks: Reshaping the Research Agenda", ACM Computer Communication Review. 26 1996, pp 19-43

[6] GSM Association - http://www.gsmworld.com/

Appendix 1

Source Code

```
<?php
/**
* Description of cGUIviewconfig
*
*/
require_once('cGUIdesign.php');
class cGUIform extends cGUIdesign {
  //put your code here
  public $stafftitle="
<h2>eCard: Recharge Phone without Recharge Cards</h2>
        <p>eCard is an eportal system that allows you recharge your phone online without necessary
  specifying any recharge card.
        With this eCard System, you simply provide your Account Number that you have registered on
  our portal system along with the amount to be loaded on the specified phone number.</p>
```

```
        <p>eCard eliminate the issue of generating or using recharge cards in the Telecommunication
  World.
        </p>
        <p>With eCard you are out of the hassle of loading Recharge Cards.<br><br>Select your
  network from the list of Network Operators.</p>";
  public $date1='';
  public $date2='';
  public $staffid='';
  public $dept='';
  public $status='1';
  public $heading='';
  public $uploadmsg='';
  public $pfname='ecard';
  public $command="Recharge";
  public $password="";
  public function getDBcontents($ssql=''){
    if (trim($_SESSION['user.login.error']) !=''){
      //$rs[0]['staffid']= $_SESSION["user.login.staffid"];
      //$rs[0]['password']=$_SESSION["user.login.password"];
      $rs[0]['dept']=$_SESSION["user.login.dept"];
// $_SESSION["user.login.staffid"]="";
      $_SESSION["user.login.password"]="";
// $_SESSION["user.login.dept"]="";
    }
    else {
//Below if filling the controls with DB contents
//Also, adding personal controls along
$this->tablecolumns=null;
$cnt = $this->getDBcontents();
$Rs = $cnt;
$rs = $Rs[0];
      $this->tablewidth=550;
      $this->tablecolumns='';
      $ctr =null;
      $ctr["<b><center>Click on your desired Network Operator</b></center>"]='';
  $this->addTableHeadings($ctr);
//Rendering to Standard HTML Output
  $renders = $this->renderGUIToWeb($this->tablecolumns) ;
       $ctr =null;
       $cnt= null;
       $this->tablecolumns=null;
       $this->tablecolumns[0]='';
       $ctr[0][0]['type'] ='link';
       $ctr[0][0]['name'] ='mnews.php?gui=cGUIrecharge.php?nw=Airtel';
       $ctr[0][0]['value'] = 'AirTel Network(ZAIN)';
            $ctr[0][1]['type'] ='link';
       $ctr[0][1]['name'] ='mnews.php?gui=cGUIrecharge.php?nw=MTN';
       $ctr[0][1]['value'] = 'MTN Network';
// alert("'. $p . '")
// </script>
// ';
```

```
//// }
//
// $_SESSION['user.login.error']='';
// $_SESSION['user.login.success']='';
          $this->AddNewRows($ctr);
            // echo '
              // <script type="text/javascript">
//Rendering to Standard HTML Output
echo $this->renderToWeb($renders . $this->renderGUIToWeb($this->tablecolumns))
     ;
  }
  public function process(){
          $this->formname='index.php';
          $this->action= $this->formname;
          $wcnt = $this->getGUIContentsFromWeb();
          $rslt =$this->parseWebContents($wcnt);
          $_SESSION['admin.login.user']="";
          if (!empty($rslt) && (empty($_FILES))){
            $web =$rslt[0]; $cmd =$rslt[1]; $row= $rslt[2];
            if ($row<0){
              $this->date1=-1;
            }
            else{
              $web =$rslt[0]; $cmd =$rslt[1]; $row= $rslt[2];
              if ($row >=0){
                $this->processWebContents($web, $cmd,$rslt[3],$row);
              }
// print_r($_SESSION);
// exit;
        if ($state == "1"){
        return "Your Account <$id> has been DEBITED! Current Balance <$balance>. $msisdn was
successfully CREDITED with N$amount";
}
        switch ($state)
        {
          case "2": $msg = "Insufficent Funds N$balance in your Account! <br>
                    Amount N$amount was to be deducted. ";
            break;
          case "3": $msg = "Provided <$msisdn> is NOT ACTIVE!";
            break;
          case "4": $msg = "Your Account <$id> not available!";
            break;
        }
        return "Could not Credit <$msisdn> due to ".
            $msg;
}
?>
```