

SEWING DATA TRANSMISSION THROUGH MOBILE PHONES

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ABSTRACT

In the SEWING project the problem of transmitting data from the smart chemical sensors is still open. Using the new wireless connectivity technology for net building, we can achieve new quality, reliability and ergonomic rules for users. If your beaten track for construction of standard solutions will be a little bit changed towards other alternatives, everything will be easier and simpler. In this paper also is presented on simple example how to build a smart WAP (Wireless Application Protocol) applications valuable for data transmission.

1. Introduction.

In that paper it is presented how in an effective way one can implement wireless communication, WAP (Wireless Application Protocol) applications and achieve interesting solutions for e.g. distributed and spread measuring systems structures. It's dedicated to anyone who is interested with wireless technology and wants to improve his or her knowledge for use it in real, practical implementation for communication.

Today's solutions in second generation of mobile phones enabled three main ways of communication. The first CSD (Circuit Switched Data) about 9.6/14.4 [kbps], the second HSCSD (High Speed Circuit Switched Data) /GPRS (General Packet Radio Service) about 43.2/115.2/128 [kbps]), and the third point to point communication between wireless terminals, included also in all SMS messaging. Solutions presented here can be very useful also for future generations of wireless technology like UMTS (Universal Mobile Telecommunication System).

In short , Internet access or other "machine" access by mobile phone and WAP is similar to WWW and radio wireless model of communication (Fig. 1). Sample of source-code and final results, which can be obtained by using this method, are presented in Fig. 2.

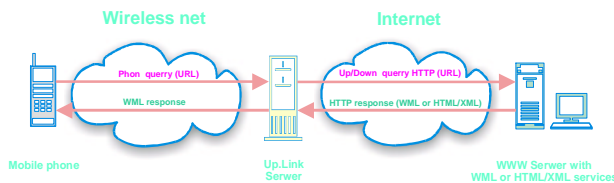


Fig. 1 Access to I*net by mobile phones and WAP.

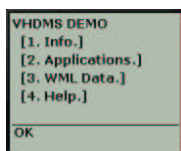


Fig. 2 Phone display with WAP application.

A part of source-code for realisation of the screen presented above, which should be inserted, is as follows:

```
...<wml>...
<card title="WML Examples">
  <p mode="wrap"><big>VHDMS DEMO</big></p>
  <p mode="nowrap">
    VHDMS DEMO<br/>
    <em><a href="...">1. Info.</a></em><br/>
    <em><a href="...">2. Applications.</a></em><br/>
    <em><a href="...">3. WML Data.</a></em><br/>
    <em><a href="...">4. Help.</a></em><br/>
  </p>
</card>
<card id="info"><p>nformacje
  <select>
<option onpick="../scripts/wml_info.wml">Co to jest WML ?</option>
<option onpick="../scripts/apps_menu.wml">Kilka Aplikacji WML</option>
  </select>
</p>
</card>
...</wml>...
```

For that results we need to establish the link connection between system and their terminals, what is discussed in the next section.

2. Wireless links in GSM.

As the first step we need to choose GSM operator e.g. in Poland **ERA GSM** and mobile phones or GSM modules for tests e.g. **Siemens ME45**.

Phone sets had all accessories like cables what was very attractive for users and what was an advantage during choosing the equipment.

In low binary transfer mode (9600/14400 [bps]) we can establish the connection easy. The configuration, in real, is almost equal to the GSM operator description and advices. Mobile phone and computer parameters were given right and work properly (e.g. DNS addresses for WAP configuration). Sets of all parameters and access by numbers 604010101 and 604020202 give the possibility and the way of wireless communication.

Configuration below was established as correct.

Mobile phone configuration:

Profile erawap

Profile name: e.g. erawap

WAP configuration:

IP address 213.158.194.194

IP port: 9201

CSD address: 213.158.194.194

CSD port: 9201

WAP home site e.g.: <http://wap.era.pl>

Support time e.g.: 300 [s]

CSD configuration (+48 direct number for Poland):

Dial-Up number: +48604010101/604020202

Connection type: Analog

Username: eranet

Password: eranet

Computer configuration:

Communication port: e.g. COM1:

- must be switched-on (required),

- transmission speed: e.g. max. 128000 [bps]

Modem (right for Siemens S45 Analog) V.32 lub V.34:

- choose the modem from the list (if some),

- choose the tone dialing,

- set the transmission speed:

e.g. max. 128000 [bps]

- set the dialing number as:

604010101 or 604020202,

- input the username and the password as:
eranet or erainternet,

Important TCP/IP protocol parameters:

- set LCP extensions,

- set negotiate connection many times,

- set software compression – switch-on or off,

- set automatically acquiring IP and DNS addr,

In GPRS mode of connectivity at first it wasn't possible to establish the link properly. The main reason was the GSM operator problems. Type of the GSM operator problems is discussed at the end of that chapter.

After many explanation and consultations with the GSM operator configuration below was established as correct.

Mobile phone configuration:

Profile GPRS

Profile name: e.g. gprs

WAP configuration:

(service could be not activated in GPRS mode by the operator, if you want, ask the operator for that)

IP address IP: 213.158.194.194

IP port:9201

CSD address: 213.158.194.194

CSD port: 9201

WAP home site e.g.: <http://wap.era.pl>

Support time e.g.: 300 [s]

CSD configuration:

Dial-Up number: 604010101

Connection type: Analog

Username: erainternet

Password: erainternet

GPRS data:

Switch mode on

APN: erainternet

Username: erainternet

Password: erainternet

Data exchange configuration:

GPRS – yes,

Authentication – no,

Computer configuration:

Communication port: e.g. COM1:

- must be switched on (required),

- transmission speed: e.g. max. 128000 [bps]

Modem (right for Siemens S45 GPRS) GPRS:

- choose the modem from the list (if some),

- switch-off additional dialing rules (no +48),

- choose the tone dialing,

- switch-on hardware flow control,

- set the transmission speed:

e.g. max. 128000 [bps]

- set and input additional AT command for the GPRS modem for Siemens S45 mobile phone modem appropriate for used operating system:

+cgdcont=1,"IP","erainternet" or

At^sgauth=1<cr><ls>At+cgdcont=1,"IP","erainternet"

- input the GPRS number as: *99***#1,

- input the username and the password as:
eranet or erainternet,

- choose advanced (non-standard) parameters and set:

- optional ciphering,

- permit for these protocol use ,

- set non-ciphering password (PAP),

- other option switch-off,,

Important TCP/IP protocol parameters:

- set LCP extensions,

- set negotiate connection many times,

- set software compression – switch off (rather),

- set automatically acquiring IP and DNS addr,

By using setup like above, we can establish GSM wireless link and access to the Internet with 128000 [bps] data speed transmission. Surprisingly, it required too much consultations and setup checking due to lack of data for configuration not clearly acquired from GSM operator. The main problem on GSM operator side was a wrong configuration and wrong service activation and access for users.

Point to point connectivity can be realised by HyperTerminal software in Windows operating system. At first we need to activate added numbers for phone

(special numbers for e.g. data transmission – option activated by GSM operator).

After plug-in of the mobile phones as modems to computers (e.g. laptops) we can dial-up on special addend number of the second mobile phone and access the remote machine. We use for it the CSD option of connectivity and V.32/34 modem and its configuration (before dial-up on the second mobile we need to invoke the option 'wait for call').

In test phase we need to manually take up the receiver in the remote mobile phone. With additional AT command we can enable it into automatic mode. After connection establishment we can transfer alphanumeric and binary data with success between machines, what has been tested.

During tests also M2M (Machine to Machine) technology was recognised for target use in SEWING project. M2M module (e.g. Nokia 30) is a valuable GSM mobile phone usually without classical display and keyboard, of course also for use e.g. with stronger waterproof casing.

3. Dynamic WML.

Standard WAP solution presented in chapter 1 is basic and static, not flexible enough for some purposes. How to get a smart WAP application is a principal question in 'e' and 'M-Business' (where 'e' means 'electronic' and 'M' means 'mobile') and in distributed systems used for many purposes e.g. for communication and data exchange in systems designed in SEWING. One important conclusion is found in this investigation which looks obvious. Graphical information (like a picture) brings and provides more information for users than sophisticated, but boring, information in the form of a text.

As a first step the possibility for getting the barchart using a table is considered like a semi-graphic picture. For data access from database we can simply use ASP (Server Active Pages) technique with VBScript (Visual Basic ...) or something else like PHP (Personal Home Pages). The screen below and parts of a source-code are given as an example and present what can be finally achieved using this method (Fig.3).

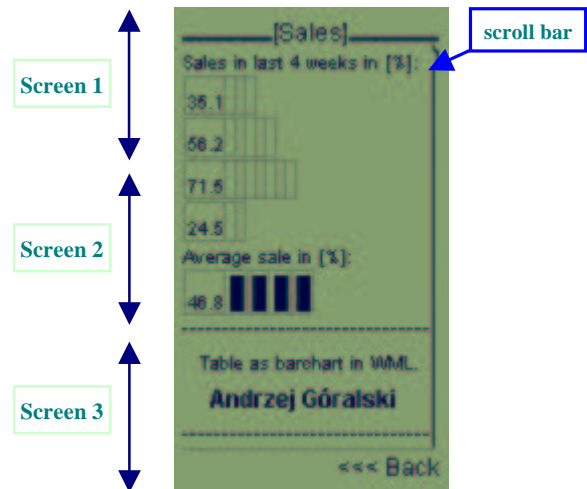


Fig. 3 Bar chart as a table.

A part of source-code for screen presented above:

```

...
<card id="card1" title="[Sales]" newcontext="true">
...
<p align="left">
<small>Sales in last 4 weeks in [%]:</small><br>
<table columns="4" align="CCC">
<tr>
<td><small>35.1</small></td>
</tr>
</table>
<table columns="6" align="CCC">
<tr>
<td><small>56.2</small></td>
</tr>
</table>
<table columns="8" align="CCC">
<tr>
<td><small>71.5</small></td>
</tr>
</table>
<table columns="3" align="CCC">
<tr>
<td><small>24.5</small></td>
</tr>
</table>
</p>
<p align="left">
<small>Average sale in [%]:</small>
<table columns="5" align="CCC">
<tr>
<td><small>46.8</small></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</table>
</p>
<p align="center">
-----
<small>Table as barchart in WML.</small>
<em><br>Andrzej Góralski</em>
-----
</p>
...
</card>
...

```

The main part of this application is a table and a smart use of the tag. In WML, in tag '<table>' we must define the number of columns, that is required, for example:

```

...
<table columns="3" align="CCC">
...

```

Alignment can be realised by combination of three letters, where 'C' mean centre, 'L' – left and 'R' – right (description by full words for example 'centre' is also possible in some interpreters, one needs to check it in the documentation files).

What is important to remember is that the source-code is different after decoding than before compilation. It very often occurs if you use WAP kit, RAD (Rapid Application Development) environment. Another problem is the nesting tags and their order in source. It's very often that a little bit different order of tags cause parse error, partially it depends on implementation of DTD file (XML element) and application implementation for example in Java language class and method inheritance. Elimination of those skews takes an additional time if we forget about it. We can see that problem quite often on many of 'beta' and new versions or early language versions edition release (for example in early Tcl/Tk language version).

The next step is to generate pictures by other applications or languages more suitable for that purpose and convert them and maybe resize (resample, resize or both) into WBMP (Wireless Bitmap) format readable by software or hardware of WAP browsers implemented in mobile devices like phones. A good solution of that idea has been found. This proposal is a combination of PHP script and external WBMP converter. The result occurred more interesting than expected.

Summarising the basic idea is as follows:

- invoke from starting WML card external script for picture creation,
- in external script connect with database and get data from required record (for example from first record for test purpose),
- in PHP script (chosen language) perform picture creation, especially prepared for white and black mode in small size (about 100x120pixels) for future conversion into WBMP format,
- save created picture into a GIF or JPG file format (*WBMP is not supported now in many graphical programmes – some plug-ins are required or a new version*),
- implementation of return card for result presentation as nested WML source-code in PHP script – 'print(...WML tags...)'.

By start processing the data don't forget about right MIME typeset for WWW server in their configuration, without it the script couldn't be processed. The whole action is taken in external PHP script, executed by WWW server. Don't forget also about MIME type in PHP script for sending data in right mode to the current processing and WAP browser for visualisation.

As a result one has a nice bar chart picture in WAP browser (**Fig. 5**). Everything was achieved 'on-line' in dynamic mode (actual data got from databases – of course all data on bar chart are only for test purpose, for example one month sales for four products are chosen for visualisation).

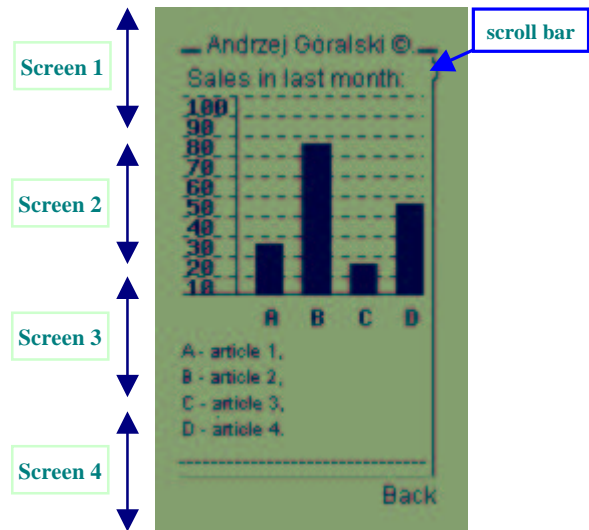


Fig. 5 Real dynamic bar chart in WBMP format.

One can find here a complete source-code for that example. It can be very valuable for creating own script. It is hard to find that type of examples in literature and in the Internet with full author's comments. In Internet discussion groups one can find many questions how to make cards in WML active for connection with databases – this is why this example has been created.

Here is a full listing for card presented in **Fig. 5**.

```

<?
// Graphics library for PHP3 or 4 – UNIX like systems library have suffix '.so'
dl("php3_gd.dll");
//Connect with database 'forwap'
//Username, password and base has 'forwap' id.
$connection = odbc_connect("forwap","forwap","forwap");
//Query settings for table 'Sales'
$query = "SELECT * from Sales";
//Run the SQL question for results get
$result = odbc_do($connection, $query);
odbc_fetch_into($result,&$fields);
//If you want more or all records use the 'while' loop for do that
//
while(odbc_fetch_into($result,&$fields))
{
    $W1 = $fields[0];
    $W2 = $fields[1];
    $W3 = $fields[2];
    $W4 = $fields[3];
}
//Use 'print' only for check purpose if something went wrong
//
print("\nW1=$W1, W2=$W2, W3=$W3, W4=$W4\n");
//
}
//Close the connection
odbc_close($connection);
//Some parameters and data for display
$GraphWidth = 120;
$GraphHeight_Real = 120;
$GraphHeight = 100;
$GraphScale = 1;
$GraphFont = 3;
$GraphData = array("$W1", "$W2", "$W3", "$W4");
//First data record in database 'forwap' contains 4 numbers like on the line below
//
$GraphData = array("25", "75", "15", "45");
$GraphLabel = array("A", "B", "C", "D");
//Make picture
$image = imagecreate($GraphWidth, $GraphHeight_Real);
//Set colours for all parts and objects in picture
$colorBody = imagecolorallocate($image, 0xFF, 0xFF, 0xFF);
$colorGrid = imagecolorallocate($image, 0x00, 0x00, 0x00);
$colorBar = imagecolorallocate($image, 0x00, 0x00, 0x00);
$colorText = imagecolorallocate($image, 0x00, 0x00, 0x00);
$colorVText = imagecolorallocate($image, 0x00, 0x00, 0x00);
//Fill the background
imagefill($image, 0, 0, $colorBody);
//Draw the vertical lines
$GridLabelWidth = imagefontwidth($GraphFont)*3 + 5;
imagine($image,
    $GridLabelWidth, 1,
    $GridLabelWidth, $GraphHeight-1,
    $colorGrid);
//Draw the horizontal lines
for($index = 0; $index < $GraphHeight; $index += $GraphHeight/10)
{
    imagedashedline($image,
        0, $index,

```

```

        $GraphWidth-1, $index,
        $colorGrid);
//Display labels
        imagestrng($image,
        $GraphFont,
        2,
        $index-1,
        round(($GraphHeight - $index)/$GraphScale),
        $colorText);
    }
//Draw bottom line
    imageline($image,
        0, $GraphHeight-1,
        $GraphWidth-1, $GraphHeight-1,
        $colorGrid);
//Draw every bar
    $BarWidth = (($GraphWidth-$GridLabelWidth)/count($GraphData)) - 10;
    for($index = 0; $index < count($GraphData); $index++)
    {
//Bar
        $BarTopX = $GridLabelWidth + (($index+1) * 10) + ($index * $BarWidth);
        $BarBottomX = $BarTopX + $BarWidth;
        $BarBottomY = $GraphHeight-1;
        $BarTopY = $BarBottomY - ($GraphData[$index] * $GraphScale);
        imagefilledrectangle($image,
            $BarTopX, $BarTopY,
            $BarBottomX, $BarBottomY,
            $colorBar);
//Calculate the position for labels
        $LabelX = $BarTopX +
            (($BarBottomX - $BarTopX)/2) -
            (imagefontheight($GraphFont)/2);
        $LabelY = $BarBottomY;
//Display horizontal labels and tune the position
        imagestrng($image,
            $GraphFont,
            $LabelX+5,
            $LabelY+5,
            "$GraphLabel[$index]",
            $colorVText);
    }
//Send picture to the WWW browser – for test only, if you need this
//MIME header for WWW browser for binary sending data as GIF file
//header("Content-type: image/gif");
//imagegif($image); //!
//Save picture as GIF file in working directory
    imagegif($image, "barchart.gif");
//Exec a converter on GIF file for convert it into WBMP format.
    exec("put_here_own_addr_for_converter barchart.gif barchart.wbmp");
//MIME header for WML browser for software or hardware browser
    header("Content-type: text/vnd.wap.wml");
//Do the WML card for display the
    print("<?xml version=1.0?>");
    print("<!DOCTYPE wml PUBLIC '-//WAPFORUM//DTD WML 1.1//EN'
'http://www.wapforum.org/DTD/wml_1.1.xml'>");
    print("<wml>");
    print("<card id='barchart_card' title=' Andrzej G&#xF3;ralski &#xA9;'
newcontext='true'>");
    print("    <p>");
    print("        Sales in last month: <br/>");
    print("        <img src='barchart.wbmp' alt='a'/><br/>");
    print("        <small>A - article 1,<br/>B - article 2,<br/>C - article 3,<br/>D -
article 4.</small>");
    print("        -----<br/>");
    print("    </p>");
//We can back to previous card in starting WML file from here !
    print("    <do type='prev' label='Back'>");
    print("        <go href='http://.../Welcome1.wml'></go>");
    print("    </do>");
    print("</card>");
    print("</wml>");
?>

```

If we change definitions of colours dedicated for barchart objects we achieve the colour version instead of only white and black, what is important for UMTS application. In 3rd generation devices displays will be in colour and WAP 2.0 protocol enables the colour presentation of data on it.

Of course, other type of diagram e.g. circle diagram also is possible for presentation in WAP browsers.

4. Conclusion.

Use the wireless GSM nets as medium of connectivity in heterogeneous and distributed (territorially to) network system for measuring is suitable and proper for technical and economical reasons.

By performed test was defined and checked right

configuration for mobile phones and computers. Three ways of connectivity were tested: CSD, GPRS and point to point, in all cases with good results. In GPRS mode main problem was made on GSM operator side. After some action taken by the GSM operator, GSM Technical Centre and Siemens Technical Support all GSM operators problems were solved and removed. Sometimes it very important to update the mobile phone firmware into newest version what can be obtained in that case from the: <http://www.my-siemens.com> website.

For economical reasons the GPRS connectivity is the cheapest. The payment unit (May-June 2002) 0,06 PLN is charged for 10 [kB] data transfer. In CSD mode charge unit is for 1 [min] of connection without or with data transmission.

By those tests all achieved results can be implemented fully in designed systems in SEWING project.

Next steps taken for the development of the current results and achieved solution will be M2M and Bluetooth modules usage in real environment implementation. Only flexible use M2M modules and classic mobile phones gives us advantage in administering, data acquiring and supervising the system activity and transfer data on demand or alarm mode.

Communication possibilities developed for wireless way of information access made new quality. Here in that paper it tried to present some new ideas how to build smart wireless links and WAP application also useable for UMTS application in 3rd generation of mobile communication. If we'll think in a little different way, these solutions will be more concurrent to other ones. It's important to understand that standard way of thinking sometimes is not so useful for construction of something new, if one wants to achieve a new quality and improved solution.

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