A Simple Web Platform Solution for M-Learning

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Nowadays the role of educational platforms is more than obvious, thanks to websites and modern platforms like Microsoft SharePoint designed for e-learning. We consider that the next generation of learning platforms will be m-learning platforms. These kind of platforms offer first of all mobility for the potential users of PDAs, pocket PCs, smart phones and other modern mobile devices, discovered and developed in last years. One of the most important aspect of these manners of e-learning is the display mode. Classic systems like personal computers have a bigger screen, modern portable devices have a few inches screens and the problem is to adapt the structure of websites and platforms for pocket PC screens and in the same time to develop the capability to produce same experience and usefulness to all users.
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1 Introduction

Use of mobile systems increased, and will further grow, due to the emergence of third generation wireless networks and since technology, devices and infrastructures matured. This has lead to development of diverse kinds of systems, including m-learning, which can be used by a variety of users, for different tasks. Among others, students traveling by bus or train can read course summaries, perform online quizzes or assessments, and send them to the relevant instructor; company workers can use these systems for specific training, using any free time, wherever workers are situated; travelers can avoid carrying travel books when visiting old towns, and receive the desired information using their mobile device [1].

The capabilities of mobile devices, such as mobile phones, have improved in recent years. New phones are capable of exchanging voices, text, pictures and video. In addition, the wireless network provides high-speed connections with low costs to mobile subscribers. With the existing technology both in mobile devices and in the network these devices are capable in offering more services and can be utilized as an additional tool [2].

During the past years, there has been a quickly rising interest in radio access technologies for providing mobile as well as nomadic and fixed services for voice, video and data. The difference in design, implementation, and use between telecom and data communications technologies is also getting more blurred. One example is cellular technologies from the telecom world being used for broadband data and wireless LAN from the data communications world being used for voice over IP. Today, the most widespread radio access technology for mobile communication is digital cellular, with the number of user forecasted to reach 3 billion by 2007, which is almost half of the world's population. It has emerged from early deployments of an expensive voice service for a few car-borne users, to today's widespread use of third generation mobile-communication devices that provide a range of mobile services and often include camera, MP3 player and PDA functions. With this widespread use and increasing interest in 3G, a continuing evolution ahead is foreseen

Yet, the most common method of developing for mobile web is using XHTML (Extensible Hypertext Markup Language) and WML (Wireless Markup Language) [w3.org]. Use of content-only markups like RSS [Rich Site Summary] and other micro-formats is also on a rise. With this, the device itself can decide how to present the information, while the website only provides the content.

1.1 WAP

If you have been around the technology industry for a while, you may remember the hype around mobile web and WAP in the 1999 – 2000 days—

just before the bubble burst. You may also remember the phone Neo used in the movie The Matrix. That phone was Nokia 7100, the first phone to support WAP—Wireless Access Protocol. WAP is the protocol to access the Internet from a mobile device. It provided an XML based language—Wireless Markup Language (WML), using which you could do mobile web application development.

Though served over normal HTTP server, the WAP architecture has a gateway between the server and the client. This gateway encodes the content in binary form to save bandwidth before sending it to the client and allows monitoring usage by the service provider.

The WAP specifications have evolved over time, and the standard now is WAP 2.0. This adopts an XHTML variant—XHTML Mobile Profile (XHTML-MP). XHTML-MP offers richer presentation and is very similar to HTML. We are going to use XHTML-MP for this book.

1.2 Bringing Order with Standards and Guidelines

The only way to bring order to the chaos in mobile development is to establish standards and guidelines. W3C's Mobile Web Initiative has been instrumental in this. It has best practices for mobile web development, and also a specification mobileOK to determine whether your site can work on various mobiles or not.

XHTML Mobile Profile is the standard language for mobile web development. XHTML-MP is built on top of XHTML Basic. W3C developed XHTML Basic originally for mobile devices but Open Mobile Alliance (OMA) added support for WAP CSS (WCSS) and other usability enhancements over XHTML Basic and defined it as XHTML-MP. Hence XHTML-MP has been adopted as a standard by device manufacturers. Most phones support it.

There are many opinions about mobile web development today. Because the need is to show mobile web content in an acceptable manner to a wide variety of handsets and browsers, the two most common practices are "adaptation" and "lowest common denominator".

Adaptation, sometimes called multiserving, means delivering content as per the device's capabilities. Adapt the content to suit the device so that it looks best to the user. Different techniques are used for adaptation—including detection, redirection, setting correct MIME types, changing links, and removing or scaling graphics. The "lowest common denominator" or

LCD method establishes a minimum set of features expected from the device and develops content adhering to those guidelines. The minimum expected feature set is also called the Default Delivery Context (DDC).

1.3 W3C-Defined Default Delivery Context
Usable Screen Width: 120 pixels, minimum
Markup Language Support: XHTML Basic 1.1 delivered with content type application/xhtml+xml
Character Encoding: UTF-8
Image Format Support: JPEG, GIF 89a
Maximum Total Page Weight: 20 kilobytes
Colors: 256 Colors minimum
Style Sheet Support: CSS Level 1. In addition, CSS Level 2 *@media* rule together with the *handheld* and *all* media types
HTTP: HTTP/1.0 or more recent HTTP 1.1
Script: No support for client-side scripting

1.4 Adaptation is better, but LCD is easier
Adapting according to the device capabilities is the ideal solution for delivering mobile web. At the same time, most developers will want to first achieve LCD before doing adaptation. The reasons for going with the lowest common denominator are many. Adaptation involves extra cost and complexity. It also requires changes on the server side to detect and deliver content; this may not be possible for all. If you are doing mobile development for the first time, it may not be easy to adapt. LCD may also be sufficient in cases where usage of the mobile site is limited. For our examples, we will start with LCD and move to adaptation in later chapters.
Let's do a quick review:
- Things are moving mobile! There are already successful mobile web applications.
  - Mobiles will reach 60% of the world population by 2010. For many users, this will be the first exposure to high tech and internet. A mobile device will be their first computer!
- Mobile data usage around the world is growing exponentially.
- Mobile web is about delivering the Web to mobile, and to utilize features of the mobile platform.
- Mobile devices come in all shapes in sizes features, screen sizes, input, connectivity, multimedia, etc.
- Mobile usability is a big challenge people use mobiles differently from their desktops.
- XHTML-MP is the standard language for

mobile web development.
- Adaptation is the ideal method for content delivery, but lowest common denominator may work.
- The opportunity for mobile web is huge! [3]
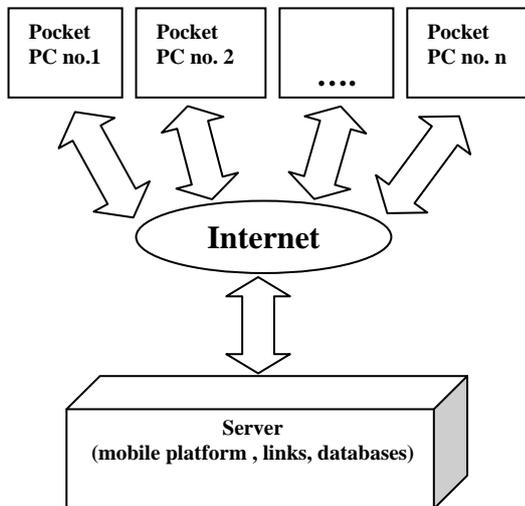
Fig. 1. Communication diagram

A revolutionary way to accomplish the needs of education is to introduce an m-learning platform which provides a central access point for students in order to communicate with their teachers to enter the online tutorials, to complete some tests, to participate in the discussion groups, to download courses and seminars, to schedule exams and other forms of evaluation.

The communication diagram between users and teachers to access resources can be figured as in figure 1.

1.1 The advantages of m-learning
- Students can interact with each other and the practitioner instead of hiding behind large monitors.
- Much easier to accommodate several mobile devices in a classroom than several desktops, as require far less space.
- PDAs or tablets holding notes and e-books are lighter, less bulky and easier to carry than bags full of files, paper and textbooks, or even laptops.
- The handwriting recognition software in PDAs and tablets have been found to help improve students handwriting skills.
- Handwriting with the stylus pen is more natural than using keyboard and mouse.
- Can draw diagrams, maps, sketches directly onto a tablet, using standard software.
- Can take notes directly into the device during outdoor lessons or on field trips, either typed,

handwritten or voice.
- Electronic registration and inputting data in practical lessons or outdoors where desktops are not appropriate or too cumbersome e.g. science experiments, kitchens, farms.
- Shared assignments and collaborative working, so several students and the practitioner can pass the device around a group, or "beam" the work to each other using the infrared function of a PDA, or a wireless network such as Bluetooth.
- Practitioners can more easily and naturally annotate work using the pen.
- Can be used anywhere, anytime, including at home, on the train, in hotels - such places are conducive to learning because you cannot be disturbed by meetings, you are often alone, it might be quiet - this is invaluable for work-based training.
- Stylus pens are much more natural for web browsing - click directly on links etc with the pen instead of using a mouse.
- Can trace an image directly onto the tablet's screen.
- Engaging learners - young people who may have lost interest in education do like mobile phones, gadgets and games devices such as GameBoy.
- Increases motivation and personal commitment to learning if a student can "own" a device and take it with him/her wherever he/she goes, and encourages responsibility.
- May contribute to combating the digital divide, as generally cheaper than desktops, especially mobiles and PDAs.
- Just-in-time learning/reference tool for quick access to data in the field e.g. accessing step-by-step guides to help you achieve a task.
- SMS can be used to get information (e.g. timetable changes) to staff and learners more easily and quickly than phone calls or email.
- As assistive technology for learners with learning difficulties and/or disabilities - see accessibility below. [4]

1.5 The disadvantages of m-learning
The limitation of m-learning is a combination of technical and education challenges. Some of these disadvantages may disappear as technology improves.

1.5.1 Fragmented Learning Experience
"Learning requires concentration and reflection.

However, being on-the-go (riding a train, sitting in a cafe, walking down the street) is fraught with distractions. Students are in situations that place unpredictable but important demands on their attention. This leaves the mobile learner with a highly distracted, highly fragmented experience. The learning application must be designed with this in mind."

1.5.2 Lack of Well-Developed Metacognitive Skills

Metacognition refers to the ability of learners to be aware of and monitor their learning processes. Adult education literature counsels that the more learners understand about how they learn best, the better able they are to assess how well they are learning and to manage their own learning. The challenge in wireless and m-learning is that learners have little experience with this delivery mode and the related instructional strategies. Experts (Peters, 2000) have suggested that "some employees are unsure about evaluating their personal learning experiences. The lack of external feedback can cause learners to question their goals and achievements." Using m-learning delivery devices and strategies for self-directed learning compounds this challenge. When talking about metacognitive skills, a distinction needs to be made between the learners' ability to self-monitor and their ability to self-assess. Learners can easily monitor their progress against a plan that tracks task completion, time on task, and quiz scores. The more difficult metacognitive skill is self-assessment, the learner's ability to judge how well he or she has actually done learning and transferring new skill and knowledge.

1.5.3 Small Screens and Difficulty Accessing Information from the Web

Mobile and wireless devices have significant disadvantages relative to screen size and ability to access information designed for traditional PC-based Web viewing. Currently, the best we can hope for are websites that are basically scaled-down and redesigned to eliminate graphics and multi-column layouts. At worst, websites offer no mobile version, so you get crunched images and skinny columns that are almost impossible to read. Clearly, traditional websites are intended for a big-screen user experience. Putting them on a small screen is like the dog that sings: the miracle is that it does so at all. While a technical feat, usability is never going to be good. To cater to mobile devices, websites and services should offer much shorter articles, dramatically simplified navigation, and highly selective features, retaining only what's needed in a mobile setting.

1.5.4 High Costs

One of the biggest disadvantages and drawbacks for using a mobile wireless e-learning solution is cost. Recommending m-learning or wireless learning means investing in devices for each learner, paying for wireless service, budgeting for maintenance repair and upgrades, and support from an IT group to answer users' questions and resolve technical problems. It takes a compelling business case to implement this kind of technology for learning.

1.5.5 Challenges to the Security of the Device and Its Data

Security is a challenge in the office environment with desktop PCs, and that challenge is magnified with mobile devices. Because of their size and portability, they are easy to lose, subject to damage, and more likely to be stolen than desktop systems. There are also serious considerations regarding data security. In a *Computer World* article, Muir (2003) estimates that "probably fewer than 10 percent of mobile devices used by major organizations have serious protection for stored data. This vulnerability persists despite the annual Computer Security Institute/FBI studies that document substantial financial losses associated with theft and exposure of confidential data and despite federal regulations governing the security of private data collected by financial and health care organizations."[5]

2 A simple M-learning platform

When it comes time to implement new technology solutions, universities either shop around to find the vendors, programs and/or equipment to meet their needs, or they build the technology themselves.

In actual context of economic crisis, our goal is to design, implement and develop a simple m-learning platform for mobile devices. The target students are those engaged at distance education process, potential users of pocket PCs, PDAs and other mobile devices.

The role of this platform is to give students the access to information anytime and anyplace they are. Such mobility provides the possibility of students to communicate with their teachers and their colleagues to improve educational process

at distance.

2.1 Important steps considered for developing mobile platforms
We should consider few steps to be followed to build the structure of platform to mobile:
- specific mobile html codes placed ahead of html header tells to the browsers how to interpret the pages of mobile platform
- the level of depth is good to be as short as possible
- each page must have links to previous and home page
- the information needs to be well structured
- only important information should be visible in page
- the number of images will be reduced, only one per page
- the pages needs to be simple and same time download shortly, almost instantly because the price for accessing the Internet from Pocket PCs is not very low and the time spent on the Internet has to be as short as possible.

2.2 Important materials posted on the mobile platform
- dedicated sections based on specialization of students
- materials of study-course, labs and seminars
- learning plan, scheduling calendar
- meetings, contact addresses, rules, tutors list, exam results and others.

3 A simple web platform solution for M-learning [6]
To develop an m-learning website we choose this solution: a common workstation (PC compatible) with Windows XP Professional Service Pack 2 on it. We also need a web server and we have to install the IIS (Internet Information Services) to create the local Intranet webpage. After that we place the content of our website inside of c:\>InetPub/wwwroot.
The index page is index.html placed in this directory. Our computer has a false IP address behind a real IP address so the IP should be between 192.168.1.1 -> 192.168.1.254.
To access the mobile website from outside through Internet we need to make port forwarding in the communication server. In this case we choose the port 5555 and we use in our communication server (based on FreeBSD operating system) the following line placed in

firewall in *etc/pf.conf*:

```
rdr on $ext_if proto tcp from any
   to our_real_ip port 5555 ->
      \ our_false_ip port 80
```

With this command the users have access to our index page from any browser like this:

```
http://our_ip_real:5555
```

So, to access our application we type in our mobile browser address the following line:

```
http://tbs.ubbcluj.ro:5555
```

The applications requirements are any mobile browser installed, like Internet Explorer, Opera, Opera Mini, NetFront and Internet Connection on the mobile device such as Wi-Fi, EDGE or 3G with HSDPA.

3.1 Authentication form
After the page is loaded, the browser displays the authentication form. This situation is presented in figure 2. This form was implemented with JavaScript code and looks like this one:

```
<p align="center">
      <input type="button"
      value="Login" name="Submit"
      onclick=javascript:validate(
      text2.value,"student",text1.
      value,"studentid")style="col
      or: #990099" >
</p>

</form>
      <script language =
"javascript">

      function
validate(text1,text2,text3,text4)
{
 if (text1==text2 && text3==text4)
 load('/mobisite/mobi.html');
 else
 {
  load('/mobisite/gresit.html');
 }
}
function load(url)
{
 location.href=url;
}
</script>
```

Fig. 2. Authentication form

The users have to introduce a unique user and a unique password, for our test case (User: student, Password: studentid).

If the id and password introduced were wrong, the user will be redirected to another page where he is warned to check his user and password and a single link to previous page, the authentication form. If the user and password were good, then our application redirects them to the main page of application mobi.html. In this case we have the screen from figure 3.
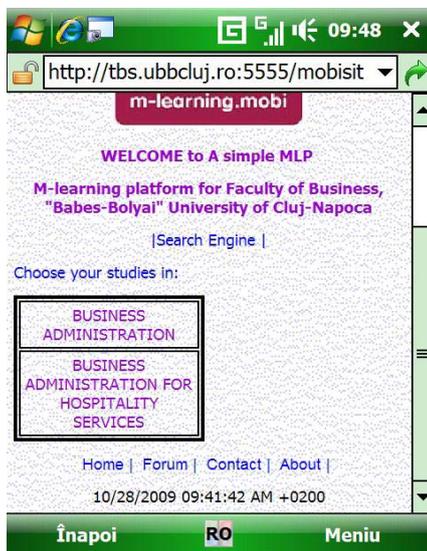
Fig. 3. The main page of application

This page contains elementary information about the university and the faculty they attend. The mobile website has a logo like the upper one, m-learning.mobi. Two important sections are represented in this screen, Business Administration (BA) and Business Administration for Hospitality Services (BAHS)

in the middle part of the main page.

In the lower part of the page we placed links to Home page, Forum page, Contact page and About page for an easier navigation.

3.2 Internal Search Engine [7]
The structure of the mobile site contains an internal search engine implemented with a script using JavaScript language.

Fig. 4. The Internal Search Engine

The search is defined to have 14 possibilities of search in the internal content of the mobile website. The keyword can be introduced and separated with "+" character. The user can search words like administration, hospitality, forum, and marketing. A fragment of the keywords description in the *search.html* file can be like this:

```
title[1]="administrarea afacerilor"
desc[1]="cautare        administrarea
afacerilor"
links[1]="http://tbs.ubbcluj.ro:5555
/mobisite/aa.html"
matched[1]=0

title[2]="servicii ospitalitate"
desc[2]="cautare          servicii
ositalitate "
links[2]="http://tbs.ubbcluj.ro:5555
/"
matched[2]=0
…
title[14]="forum"
desc[14]="cautare forum"
links[14]="http://tbs.ubbcluj.ro:555
5/forum/"
matched[14]=0
```

3.3 Discussion Forum [8]
The discussion forum was implemented using the WebWizForum and was adapted to accomplish users need. This forum is represented in next picture and allows all new users to register, to post, to reply and to communicate between and with their teachers.
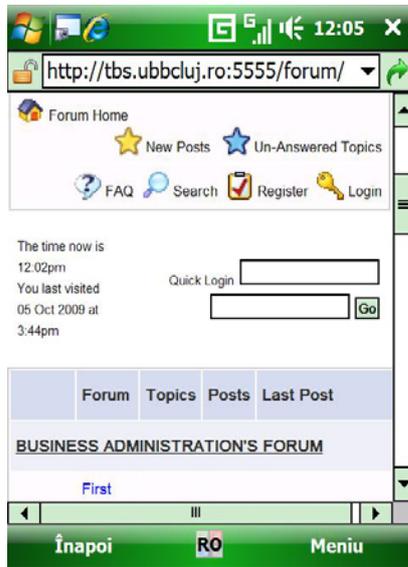

Fig. 5. The Discussion Forum

After they have completed the registration form can choose between two main section of discussion forum Business Administration and Business Administration for Hospitality Services and then the year of study between 1 and 3.

3.4 Level of depth and other parameters
We think that in mobile device development the level of depth has to be short because the time spent on wireless or 3G connections has to be reduced due to high costs. In this case the level of depth for our mobile website is 3.

BA and BAHS represent links to the main sections, each link goes to their main page we consider as first level of depth. The next level is the level of each year. Last level consists in information, announcements, courses, labs, seminars and other materials of study.

Another parameter is the size of the webpage designed for mobile devices in our case should be well structured and has only important information with links to essential sections of the platform. Each page was designed with Notepad text editor and arranged with Microsoft FrontPage.
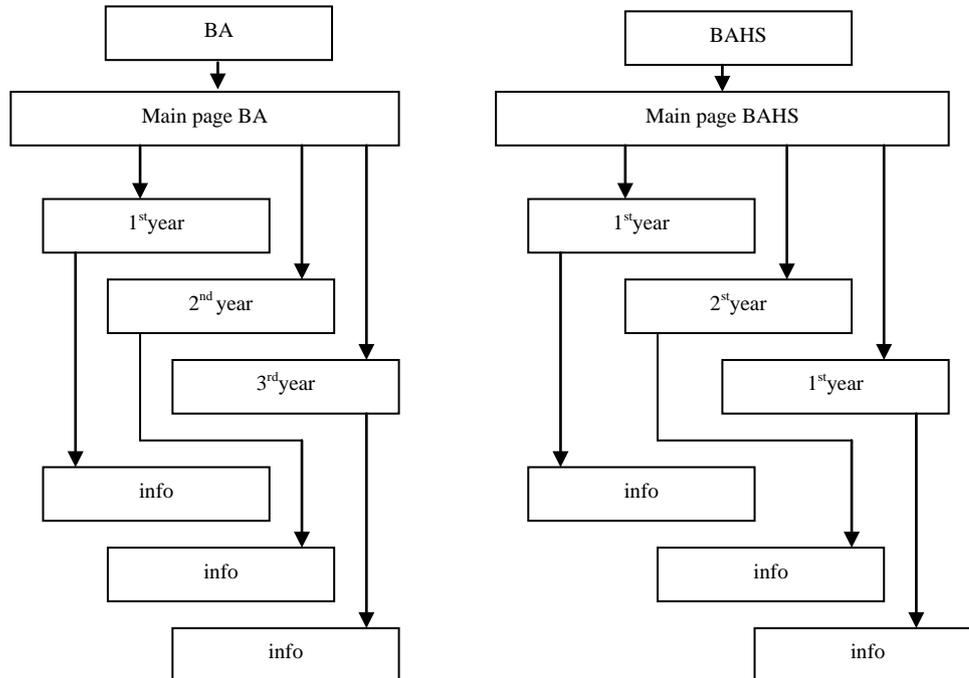
Fig. 6. The level of depth

Also any webpage in this platform has a specific header for mobile devices, like this:

```
<!DOCTYPE html PUBLIC "-
//WAPFORUM//DTD XHTML Mobile
1.0//EN"
"http://www.wapforum.org/DTD/xhtml-
mobile10.dtd">
<meta name="MobileOptimized" />
<head>
<script type="text/php"
language="php"
src="/scripts/mobile.php" ></script>
```

```
<script type="text/vbscript"
language="vbscript"
src="/scripts/mobile.asp" ></script>
<script type="text/vbscript"
language="vbscript"
src="/scripts/mobile2.asp"
></script>
</head>
```

This header is placed in every webpage of the mobile platform to tell the browsers how to parse the HTML content in our case mobile browsing.

3.5 Second level of mobile platform
This level is dedicated to each year of study. Figure 6 indicates main section of any year of study.
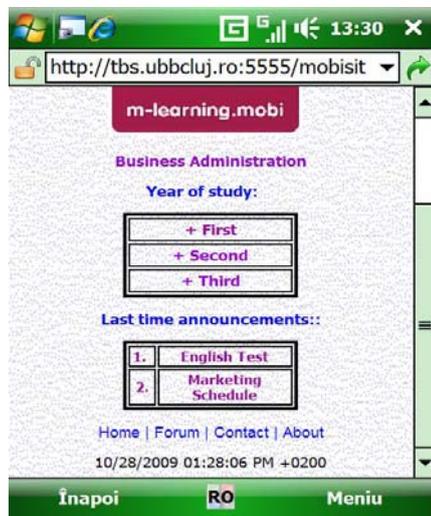
Fig. 7. Main structure section (BA)

The webpage contains other important things like last time announcement for all students of Business Administration. The same page was designed for other specialization BAHS where the years of study are unchanged, but the announcements are not the same. Every page of the m-learning platform contains the most important links:

- *Home* – to facilitate easy come back to main page
- *Forum* – to facilitate the access to login forum anytime
- *Contact* - to present main information of contact
- *About* - a short history of our university

3.6 Last level of mobile platform
The third level of the platform is also the last one. Here students can find many information like announcements (test, exams), learning plans, room's legend, courses and seminars grouped by semesters.
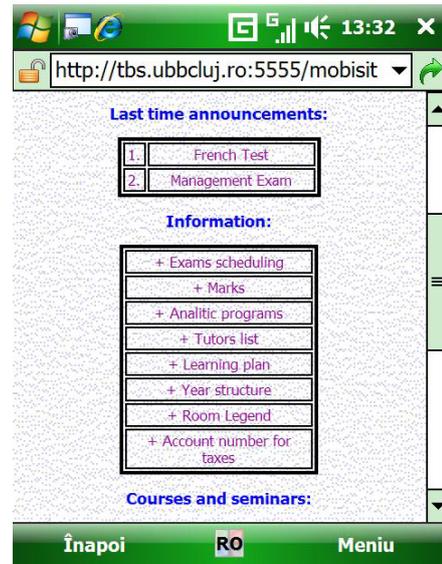

Fig. 8. Last level of mobile platform

Potential user can download all this information to Pocket PC and communicate then with colleagues and teachers. All materials are in PDF (Acrobat Reader) format. All elements of HTML are centered to facilitate the retrievable of information.

3.7 About and Contact Information
This section displays useful details about our faculty like telephone numbers, fax number, e-mail and mobile web address and a short message about the history of our faculty.
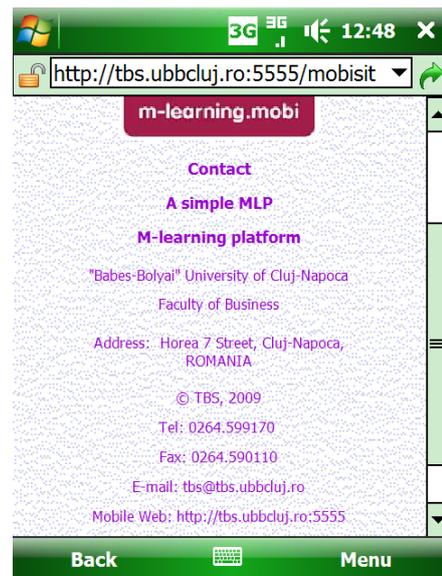
Fig. 9. Contact Information

3.8 Future development in context of actual platforms

Design is an important element of any software. In today's competitive world, where everyone can offer the same services, design has become a differentiation factor. People want to look at beautifully designed pages; their confidence in the product is higher if it is well designed. How many of us would buy an iPhone just for its features? There are other phones that provide similar or better features, but we would like to have an iPhone because of its excellent design.

Web applications have witnessed many design trends. Designs in the sites that are often classified as Web 2.0 sites have gradients, rounded corners, large types, CSS designs, and fresh colors. This style of design has worked and designers now make desktop applications as well using such styles.

The mobile web is just another platform of delivering information. All good usability practices, graphic design patterns, and software development practices are still applicable to the mobile web. They are actually a base that you build your mobile development patterns on.

What's most important for any application is that it serves user needs. We may develop a mobile website, but the users may find it very difficult to use it. We can wait for them to send us complaints or be proactive and try to find out if they are having problems [3].

Nowadays, exists different kind of mobile platforms, many of them are commercial, for buying goods or to order food at home and use SMS or credit card for paying. In this situation time spend on Internet through mobile devices should be as short as possible to reduce the costs. This involves a simple structure for the mobile platform and only relevant elements should be useful for users.

Our mobile platform was created to offer access to education for all mobile users. We tried to cover most important needs such as specific information and materials, search forum to offer the possibility of search in site, a discussion forum to let people to change impressions, useful links to most important categories. We intend to improve this mobile platform in future and to develop new techniques for mobile users. For this we have to elaborate online questionnaires and then to apply to actual users and discover what any other needs they have. Any suggestions and critics are welcome to develop a well done platform.

We consider that actual mobile platform is a good opportunity to make distance education with mobile and other handheld devices [6].

Conclusions

1. Modern technologies like 3G, Edge and HSDPA facilitates rapid access to Internet and to mobile platforms using high performance Pocket PCs and PDAs.
2. Mobile learning became a necessity in last years.
3. Next generation of educational platforms will be the mobile ones.
4. Web pages for mobile devices are designed to have a small size to be interpreted as fast as possible in mobile browser in order to reduce the costs.
5. Only relevant information is necessary on mobile web pages.
6. A mobile platform should have a discussion forum, a good search engine and a rapid interface.

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