Web Based Platform for Mobile Business Services

Eugen Pop1, Victor Croitoru2

1R&D Institute for Automation, SC IPA SA, IT&C Department, Bucharest, Romania

2"Politehnica" University Bucharest, Faculty of Electronics, Telecommunications and Information Technology, Bucharest, Romania, Corresponding Member ARA

1epop@ipa.ro, 2croitoru@ADComm.pub.ro

Abstract: Mobile business services are an attractive solution used by various economic and government agents in order to offer their products or services to a great number of potential clients. The efficiency of using and providing of these services increases significantly, due to the mobile and wireless channels used for data transmission, so the user can access these facilities from anywhere and anytime. In this paper a Web based client server platform for a stock market exchange service is presented. The electronic service content provider is the Romanian Bucharest Stock Exchange. The data is delivered to the client using a web service and socket to socket communications, which significantly reduces the data traffic, comparing with the WEB browsing. The client software applications are suitable for PDAs and Smartphones, with Windows Mobile and Symbian OS.

Keywords: Mobile business; client server platform; web service.

1. INTRODUCTION

The mobile Internet browsers give to the user the possibility to surf online, which is an opportunity to increase the data traffic of the wireless networks and, consequently, the mobile operator income. But for a mobile user it is rather difficult to surf online, because the terminal's display dimensions are not very adequate for presenting WEB pages. Consequently, there is a great necessity to develop mobile Internet applications and services, suitable for the performances, characteristics and parameters of the wireless terminals. These should be socket to socket IP packet based applications, do not involve browsing, and will give to the operators the opportunity to become services providers, for a great variety of users. A client server stock market exchange service, with demo purposes, was realized. It consists mainly of a web service, along with the server, database and mobile client software applications, for mobile services providing.

CLIENT SERVER PLATFORM ARCHITECTURE

A. Hardware Architecture

The platform's hardware architecture is adapted for data transmissions using various mobile channels, and consists of a client server architecture, as follows:

-servers, for service software tools and applications storing;

Pocket PC QTEK 2020i with Windows Mobile 2003 OS, 128 MB RAM, Intel Bulverde 520 MHz processor, mobile device;

-3G Pocket PC HTC TyTn with Windows Mobile 5.0, 6.0 OS, WLAN mobile device[10];

-3G Smartphone SE PE 990i, Symbian v9.1 OS, mobile device.

B. Software Architecture

1) The Server Software Architecture and Functions

The client server stock market transactions electronic service has the following software architecture;

-a web service, that can be accessed through a mobile client application, or browser;

-a server database application which parses, extract and store the data from the Romanian Bucharest Stock Exchange web site;

-a MySQL database which stores user accounts, daily transactions reports [6], [13];

-the site of the client server platform.

The mobile platform hardware and software architecture, is presented in Fig. 1.

Fig. 1 The hardware and software architecture of the mobile platform

The WEB service provides the basic information elements of the platform, the mobile Internet provide the access path, and the client software glues them together in a meaningful way, adding functionality to the mobile application. WEB service is a key integration technology for combining disparate systems, and is a basis for many business applications [3], [4].

Using WEB services, the stock market exchange service can be accessed by the client, regardless of the mobile operating system of the mobile device. That is why the service can be "consumed" through Android, iOS, Blackberry devices, etc. using suitable mobile software applications. The WEB service methods still remain unchanged [17]. Besides, the WEB services methods, published on the platform server, can be used by software developers to generate software applications for multiple operating systems.

2) The Mobile Client Software Functions

The mobile client software applications allow the users to access the stock exchange market e-service and facilities to and realize the data transmission functions. They consist of:

-PDA client application, suitable for Windows Mobile 2003, 5.0, 6.0 mobile operating systems;

-web service based functions, which appeal and call the stock exchange markets e-service's facilities and methods;

-TCP/IP data transmission software modules [12];

-suitable graphical user interfaces, for e-service access.

2. DEVELOPING TOOLS AND METHODS

A. Server application development

In order to implement and publish the e-service site on Internet, the following tools were used:

-HTTP application server IIS 5.1 and HTML language;

-Microsoft Visual Studio 2008, ASP.NET, VISUAL C#;

-.Net Framework 3.5, Adobe Dreamweaver CS3;

-MySQL server for storing the e-content of the service.

In order to develop client applications and WEB service interfaces for QTEK 2020i, HTC TyTN, PDA, Phone Edition, running Windows Mobile 2003, 5.0., 6.0, the following tools were used: .NET Compact Framework SDK libraries, MS Visual Studio 2005 IDE, installed on Windows XP Professional, Active Sync 4.0 etc. [1], [2].

The database can de accessed in two modes: by WEB service and through PHP scripts, containing the SQL queries. The database is continuously updated, but the information insertion can be made by accessing the Insert tab. The scripts are embedded in a php type file and can be accessed directly on the site, as web pages. The database contains several societies, currently listed at the stock first category. The PHP scripts reside on the same server as the database does, and they are appealed directly using the DNS address of the site, through a web browser. The statement has the following general form: http://localhost/query.php? Parameter=value. WEB browsers are available on Smartphone and PDA terminals. Dedicated client software applications were also developed, for Smartphone and PDAs, that achieve direct database queries, using the WEB service, not by browsing.

B. The client software applications application development tools for Sony Ericsson P990i

The client server system can use various mobile telephony terminals. Adequate tools were used to develop client applications, according to the SDK GUI platform and the operating system of the mobile phone [11].

In case of SE P990i Smartphone, the following tools, installed on a Windows XP OS PC were used, [12]:

-the UIQ 3.0 SDK GUI platform for Symbian v 9.1 [10];

-the CodeWarrior Professional 3.1 IDE, for object oriented programming, compatible with UIQ 3.0 SDK;

-ActiveSync utility software, for transferring the file, from PC in the Smartphone or PDA's internal or card memory.

3. THE STOCK MARKET EXCHANGE MOBILE SERVICE

A. WEB Service

The notion of Web service refers to the clients and servers communicating using XML messages (Extensible Markup Language) and conforms to the SOAP standard. A standardized description of operations and data types supported by the web service is published and accessible through the WSDL (Web Services Description Language) file. The WSDL file is not mandatory in terms of the SOAP queries on the server, but using and publishing it allows automatic code generation within various integrated programming environments, to develop the mobile phones client applications. (eg Microsoft Visual Studio, NetBeans, etc..). In this way, through the web service, the platform provides for the client application developers the possibility to integrate the stock exchange information in their own programs, taking advantage of the standard tools and protocols.

The WEB service is the most important software tool of the client server platform, the business component that provides stock exchange function to the clients. The mobile clients can use the WEB service from anywhere in the world and anytime, as long as the data terminal is connected to the Internet [5]. A portable data format based on XML and HTTP protocol for data transmission is used [14]. The web service's functionality and adequate methods allow mobile clients to:

-realize on-line transactions, following the evolution of the quoted societies on the Bucharest Stock Exchange market;

-create and administrate user accounts, available on the platform main server, which allow stock-exchange market demo transactions, for promoting this type of e-service;

-processing the orders placed by the users with the delay of maximum 15 min. This means the checking of the society transaction status, which is of interest for the client, along with all the conditions necessary to emit a share transaction order. The server application needs access to the local database, to perform the functional tasks mentioned above,

Some of the WEB service's methods extract the data from the suitable URL address of the BSE WEB site, at the market's closing moment.

The WEB service offers to the client fourteen WEB methods, as is presented in the Fig. 2. The query protocols used by the web methods are: Soap 1.1, 1.2, Http Post, Get.

Some of the WEB service's structure, published methods, input and output variables, query protocols, operating and functional modes are presented in the following.

1) The Issuing Company Data Method of the WEB service offers financial information about any stock market quoted company. The company transaction symbol must be provided within the query. The WEB service acquires the invoked result data from the BSE (Bucharest Stock Exchange) site, by accessing the informational resources and services.

This method input variable, provided by the user for invoking, is the issuing company „Symbol" string. The string represents the input data for the DateEmitent (string Symbol) public function of this method. In a „Try – Catch" type loop, the „DateEmitent" function realizes the following:

-defines a variable „Company" of the DateEmitent type and initializes it with the null value;

-declares an object of the HTTRequest type, as a method of the HTTPContext. Current.Request software class;

-defines an HTML Object type, called "HTMLObj";

-defines an URL string, representing the BSE's WEB page address, where the Quoted Company Current Transactions information is presented, concatenated with the company symbols, introduced by the mobile user;

-then a "String" type document is generated by the HTMLGet event of the HtmlObj software object;

-a decision software loop is launched, to verify if the generated document is not null, which means that there is some available information regarding the company; if such information exists, a new DateEmitent software class is declared, named "Company";

-some tasks regarding the text and data frames alignment are performed;

-the information parsed and achieved from the BSE's WEB page is assigned to the adequate data field of the Company class;

-the document index is set for new parsing start.

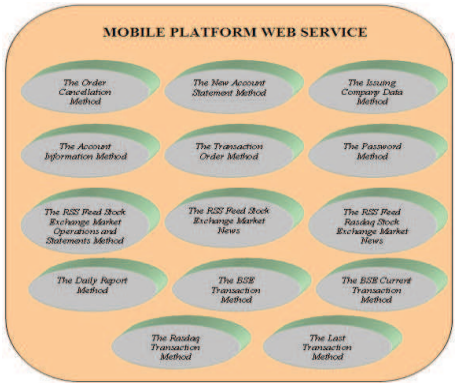

Fig. 2 The web service's methods of the platform

The output variables are the „Issuing Company Data" class member variables, representing the company information like: symbol, registration unique code, address, domains of activity, CAEN code, etc. The query protocols are Soap 1.1, 1.2, Http Post, Get.

2). The New Account Statement Method method allows the client to open user accounts, in order to utilize the interactive components of the web service. An e-mail address must be also specified by the client. The new account statment operation will be recorded, and will have effect in the local database. Automatically, an e-mail message will be transmitted to the client, comprising the account data, UserId and Password.

The method's input variables, that must be provided by the user for invoking, are the personal data: name, adress, country, town, zip code, telephone number, e-mail, etc.

The output variable is an Account class object, whose member variables comprise the user account data. The WEB method is based mainly on the public ContCreat ContNou(arguments list) founction. The arguments lists correspond to the user's personal data: First Name. Last Name, Country, Town, Zip Code, Address, Telephone, E-mail. This function, which is of ContCreat type, process the data in the following steps of a Try - Catch loop:

-define Account, a new ContCreat type class;

-initialize the Password with the null value;

-define a string of data, containing: year, month, day, our, minutes, seconds;

-a decision loop is generated, to verify if the user's personal data were introduced by the user;

-if this is the case, the software proceeds by assigning a password to the user;

-declare the MySql conection string, specifying the databse, the data source, host, user and password;

-a new database MySqlconnection object, is decared, making use of the former connection string;

-the MySqlCommand is declared, using the CreateCommand method of the MySqlConnection;

-open the MySqlConnection;

-declare the MySqlCommand.Text, in form of a frame containing the client's personal data;

-the user's personal data is stored in the database, in the corresponding columns;

-the date, password and the UserId are stored in the adequate data fields of the Account class;

-the data base MySqlconnection is closed;

-an HTML Object, HTMLObj is defined;

-some adequated confirmation messages to be sent to the user are created, and are sent to the client.

The function returns the Account class, which inherits the ContCreat class.

Through the web service, the platform provides to "third –party" client software developers the possibility to integrate stock exchange market information in their own applications, using standard tools, instruments and protocols.

The stock market exchange data upgrade operation is realized through the BSE information resources access, at the market's closing moment, when the current day transaction reports are published.

For the WEB service development, the following steps were performed, in Visual Studio C#:

-the WEB service name space http://microsoft.com/ webservices/ was defined;

-the WEB service binding, which conforms to wsiProfiles.BasicProfile1_1 was specified;

-the class Service1: System.Web.Services.WebService, of the deployment IDE was used.

B. The Server Application and the Local Database

This software tool is developed as a service, is executed in the server operating system and performs the following steps:

-administrator access to the local database;

-user accounts administration: deleting of the expired accounts, revoking user accounts when is necessary, etc.;

-to update the "Tranzaction report" table of the local database, which contains the daily transaction reports of the BSE (Bucharest Stock Exchange) market section.

The local database resides on the platform server and was developed using MySQL. 5.0. It contains the following tables:

-the "Accounts" table, which holds and manages the system registered users account data;

-the "Orders" table, allowing the storing of the users orders;

-the Transaction report" table, which allows the holding and management of daily transaction reports data;

-the "Shares" database table, allowing user stock data holding and management, for the stock - market quoted companies.

C. The Mobile Client Software Application

For the client application, the WEB service represents an interface that exposes a number of well defined WEB methods. The client application calls these methods using standard protocols, provides the parameters in an XML format and receives the response also in an XML format.

When the client application invokes a WEB service method, the WEB server expects the client to use a particular set of tags for encoding the parameters for the method. The client server WEB service supplies a description of itself, so the client knows which XML schema to use and the tags significance. The XML schema used for the response document is standardized in the WSDL (Web Service Description Language). Based on this file, the client constructs a SOAP request in the format that the WEB service understands. The client component of the platform consists of dedicated software applications for 3G PDA's and Smartphones, with Windows Mobile and Symbian OS [7], [8], [16]

4. E-SERVICE ACCESS EXPERIMENTAL RESULTS

The system client software applications functionality was tested and the results are presented in the following.

A. Stock market exchange web service access using browser

It is useful to test the web service's functionality, before consuming it on mobile channels. This allows us to establish if the web service works properly and can de used on wireless channels is possible. The calling of the WEB service, using the Tranzaction Order method, is presented in Fig. 3.

B. The Server Application

The user account administration software module of the server application, can be accessed through the application's icon in the System Tray, then activating the option Database – Account. The configuration form can be accessed by selecting the Configure submenu [15].

This software tool is developed as a service, executed in the server's operating system. The server application can be started and stopped like a Windows service, from the Service screen, or using the platform's Start Server and Stop Server commands. It performs the following functions and specifications:

-administrator access to the local database;

-user accounts administration: deleting of the expired accounts, revoking user accounts when is necessary, etc.;

-actualization of the "Transaction report" table of the database, containing the stock daily transaction reports.

At the server side, for the client access using mobile terminals, the following functions are implemented:

-"listening" to the client connections requests, at the suitable logic port;

-allowing the Request Identifier to the client request;

-displaying in a GUI of the dynamic IP client address, the client query and transmitted data, server name and IP;

-the message "Connection closed" is displayed, when this event is performed by the client.

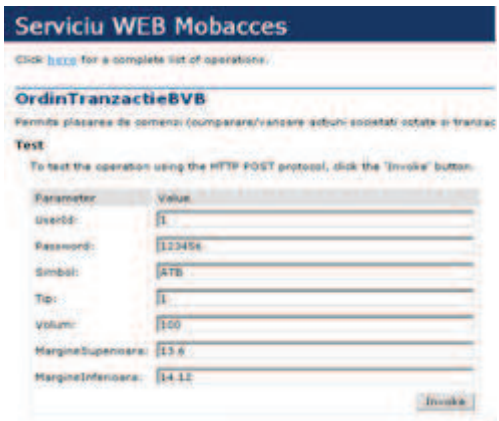

Fig 3. BSE Transaction Order WEB service method appealed from browser

C. *Mobile Client Application for PDA's*

The mobile client software component of the stock exchange e-service are developed for 3G mobile terminals, PDA's and Smartphones, with Windows Mobile and Symbian v.9.1 [9], [11] operating systems. At the beginning, by browsing, the interested users can access the server, where the client applications deployment kits are stored. After downloading, the client application can be copied, installed and launched on the mobile device. The client application use the SOAP 1.2. web protocol for communications and data transfer with the central server and the WEB service.

Using these applications, the mobile clients will gain access at the informational resources of the mobile platform, directly on Smartphones and PDAs, in mobility conditions. The data are provided by the server application, by accessing the Bucharest Stock Exchange site.

The mobile client applications interacts with the platform server through the WEB service, whose methods were described before. As it was stated before, the platform's client component has two basic applications type: for Windows Mobile and Symbian v. 9.1. UIQ 3.0. operating system. The Windows Mobile client application has a modular structure, allowing the user to access all the web service's methods, presented before. The Windows Mobile application is developed for several versions of this operating system.

Using the application's main menu, the user will be able to access and to query all the server's web methods. This is possible through the application's main graphical user interface. Atfer the query and after receiving the result, the user will come back to the main menu, to launch the next query to the server.

The main menu structure of the Windows Mobile client application contains the following submenus: Stock Market Exchange Information, Issuer Data, Last Transaction, BSE Transactions, Rasdaq Transactions, Daily Report, RSS Channels – with respect to BSE Market News, Rasdaq Market News, Accounts Statements, New Account, Account Information, Account Password, Transactions, BSE Transaction Order, Order Cancellation, Running Transactions.

Every submenu of the mobile client application corresponds to a web service method of the server. As a matter of fact,

through these submenus, the client software offers access facilities to the user, for every method of the Web service.

For example, to access the *„Issuing Company Data"* submenu, the user must perform the following commands sequence, within the Grafical User Interface: „Main Menu"-> „Stock Exchange Information"-> „Issuing Company Data". The client must introduce, within the query, the symbol of the BSE quoted issuing company, in the suitable text box of the grafical user interface. Several adminstrative and financial information about the issuing company will be displayed by the application on the mobile device screen.

The informational content is obtained by the asynchronously appealing of the „Issuing Company Data" method of the web service, previously presented. The grafical user interface for this submenu is presented in the Fig. 4 [17].

The main menu structure of the Windows Mobile client application contains the appropriate submenus that allow the clients to:

-realize web transactions, following the evolution of Bucharest Stock Exchange market quoted societies;

-create, administrate of user accounts, available on the platform's main server;

-processing the orders placed by the users with the maximum delay of 15 min, using the WEB services methods;

-access the quoted companies financial status information.

The graphical user interface for the „Issuing Company Data" submenu", for the Windows Mobile OS PDA client software application is presented in the Fig. 4.

For accesing the *„BSE Transaction Order"* Submenu the user must perform the following commands sequence:

„Menu"-> „Accounts"-> „BSE Transactions Order".

In the client application, the user is able to dispose commands, buying or selling orders for exchange market quoted and tranzactionable companies shares. The information will be obtained by asynchronous appealing of the web method „TransactionOrder".Disposing of a transaction order will have effect on the local data base.

In case that, in the client application, the user have saved the identification data of a personal account, the „UserId" and „Password" will not be visible on the terminal's dispaly. The default authentification data of the previously saved account will be used.

D) E-service access applications using web browsers

A client application, based on simple php query functions, was also developed, for quickly testing the e-service access and functionality, by web browsing, on the localhost.

This test can be performed using a laptop, PDA or Symbian Smartphone. The system database is accessed through web browser URL. The e-service database screen displays the companies quotations.

A query function realizes the following steps:

-connect to the MySQL server, using login and password;

-connect to the MySQL transactions database;

-take over the query parameter, provided by the user;

-select the database information according to the symbol, and transmit it to the client browser.

The company stock exchange information is available to the service client through the next steps:

-open the browser and enter the URL link: http://localhost/query3.php ? symbol= ATB;

Fig. 4 The „Issuing Company Data Submenu" GUI for PDA

-the browser retrieves the information for ATB (in Romanian, this stands for Antibiotics Iasi Company).

The list of companies whose quotation variation is under the maxim threshold "x" is obtained by:

-open the browser and enter http://localhost/query1.php? above=x; the companies are displayed in the browser.

The list of companies whose quotation variation is above the minim threshold "y" can be obtained by:

-open the browser and enter the address http://localhost/query2.php?sub=y; the companies are displayed in the browser.

Besides offering it's own web service, the mobile platform can use WEB services developed by other entities. That is why, a client application which uses the BSE web service was also developed for the QTEK 2020i PDA terminal.

D) Mobile Client Application for Smartphones

A client application, suitable for mobile terminals with Symbian operating system and UIQ 3.0. platform, was developed. The application's menu, has four submenus: „Companies Information" , „Minim Threshold"; „Maxim Threshold"; „E-mail".

The main client application GUI window for SE P990i mobile phone is opened by the Smartphone commands: Main Menu – Tools – Mobacces. The client user must perform then the following tasks:

-obtain the stock exchange information following application GUI: Main Menu – Info Companies, Fig.5.

-in the Company field, the symbol of the company is introduced, than the commands Done and Go are clicked;

-the Ready window displays the connection status: Connecting, Connected, Data received, Transaction Success;

-display the requested company information.

The list of companies whose quotation variation is under the maxim threshold "x" is obtained by commands:

-in the main screen, select Menu – Maxim Threshold;

-place the cursor in Threshold Maxim window, the virtual keyboard become active and the desired maximum value can be typed, for example "1"; press Done and Go;

-in the informational field, the companies that had a quotation variation under the introduced value, are displayed.

The list of companies whose quotation variation is above the minim threshold, for ex. "0" can be obtained by the commands:

-in the main screen, select Menu – Minimum Threshold;

-place the cursor in Minim Threshold window, as a result, the virtual keyboard is active, and the maximum value, for example

"0", can be typed; press Done and Go;
-in the information box the companies that had an index variation above the introduced value are displayed.

Fig. 5„InfoCompanies" Submenu GUI

5. CONCLUSIONS

A client server platform for a stock market transactions e-service was realized. The mobile client software applications allow the users to access the stock exchange market e-service information and facilities. These consist of mobile client application, suitable for 3G terminals, with several operating systems. The client applications can also be updated to be used on Smartphones, with Symbian v.9.1 OS. A WEB service was realized, with methods used for the stock exchange market e–service providing, along with suitable facilities.

The WEB service based client server mobile business platform offers to the users the following facilities:

-access to the Bucharest Stock Exchange information through mobile terminals and dedicated client application;

-the client applications of the platform use socket-to-socket data transmission that increases the information flow speed and consequently decreases the data costs;

-by using the delivery platform web service, third parties developers can realize their new client software applications.

WEB services based on SOAP protocol were used to realize the platform. Web services security (WS – Security, WSS) is an extension to SOAP to apply security to Web services. This security solution, applied within this platform, provide an increased level of security for the data traffic, than in case of using JSON or XML structured data exchange. JSON and XML structured data are accessed according to their URI, which can represent a simple and easiest transfer solution but
with a decreased level of security. Moreover, the SOAP based Web services are more efficient than the REST based ones, from the security point of view, because the last ones are using a URI based data access. These are more adequate for browser clients, which can become unsecure.

This paper is a result of the research and development activities that were developed within the project: "Mobile communications platform for data transmission and informational services access, in business environment – Mobacces" funded by the Romanian National Agency for Scientific Research, under contract CEEX - INFOSOC nr. 5/05.10.2005.

REFERENCES

[1] G. B. Shelly and C. Hoisington, "Visual Basic 2008 for Windows and Mobile Applications", Introductory, Campus BookStore, Fayetteville, AR, U.S.A 2008, ISBN: 1423927141.
[2] M. I. Fomitchev, ".Net Programming With Visual C++", Elsevier Science Ltd: 2003, ISBN: 1578201292.

[3] John Sharp, Jon Jagger, "Microsoft Visual C# .Net Deluxe Learning Edition", Microsoft Press: 2003, ISBN:0735619107.
[4] J. Sharp and J. Jagger, Microsoft Visual C# .Net Deluxe Learning Edition, Microsoft Press: 2008, ISBN:0737897628.
[5] J. Sharp, Microsoft Visual C# 2008 Step by Step, Microsoft Press: 2008, ISBN: 013 – 9780735624306.
[6] R. Vieira, Professional Sql Server 2000 Programming, Wrox Press, Inc.: 2000, ISBN: 978-0-7645-4379-1.
[7] S. Babin, A. Pranata, B. Carney, C. Notton and Feather, Douglas, "Developing Software for Symbian OS", John Wiley & Sons Inc : 2007, ISBN: 0470725702.
[8] R. Harrison, "Symbian OS C++ for Mobile Phones", John Wiley & Sons Inc: 2007, ISBN: 0470066415.
[9] B. Morris, "Symbian OS Architecture Sourcebook", John Wiley & Sons Inc:2007, ISBN: 0470018461.
[10] S., D. Liming, "Windows Xp Embedded Advanced", Independent Pub Group., 2004, ISBN: 0929392779.
[11] S. Babin, "Developing Software for Symbian OS", John Wiley & Sons Ltd, 2006.
[12] R. Harrison and R. Shackman, "Symbian OS C++ for Mobile Phones Vol. III, Application Development for Symbian OS v9", John Willey & Sons, Ltd., 2007.
[13] C. Darie and M. Bucica, "PHP5 and MySQL for Electronic Commerce". Teora, Publishing House, Bucarest, Romania, 2006
[14] F. Hirsch and J. Kemp, "Mobile WEB Services", John Willey & Sons, Ltd., 2006.
[15] K. Delaney, "Inside Microsoft SQL Server 2005" Microsoft Press 2008.
[16] D. Boling, "Programming Windows Embedded CE 6.0" Fourth Edition, Microsoft Press 2008
[17] Darcey, Laureen. & Conder., Shane. "SAMS Teach yourself Android Application Development in 24 hours", SAMS, Indianapolis, USA 2010 ISBN 10032167335-2; ISBN 13 9870-321-67335-0;
[18] E. Pop, V.Croitoru and. all, "Mobile Communications Platform for Data Transmission and Informational Services Access in Business Environment – Mobacces" in Scientific Report – Phase 5, Phase 6, CEEX -INFOSOC, Romanian National Agency for Scientific Research Bucharest, Romania, September, 2008