Mobile Parking Payment Service

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Summary

Electronic business (e-*business), as a phenomenon popularised by the Internet and the development of networking technologies, is entering a period of rapid expansion in the field of portable communications devices and their respective applications.*
In the present day there are numerous services available on the Internet via wireless networking technologies. Mobile phones have proved themselves to be an ideal platform for conducting e-business because of their practicality, availability and simplicity of usage. One of the examples of practical efficiency of a mobile phone is the option of paying for services via short textual messages (SMS) through Wireless Application Protocol (WAP). The SMS parking service is a relatively fresh service on the market (not the only one of the sort). It is used primarily in the urban, city areas world wide and it represents a significant contribution to e-business. Simplicity, compatibility, availability and the option of paying for a service at any time from any place makes this way of conducting payment very acceptable to the end users. Besides its practicality and simplicity mobile payment is widely available. There is a report available at any point on the current state of the charge as well as on the expiration time of the service. The WAP protocol and the SMS service represent the foundation of concepts on which the electronic charge of services through portable communications devices is based. Using alternative methods of the mobile payment service like integrated applications on the portable communications device, using Near-Field Communications (NFC) technology or the Internet requires more time and larger amounts of transferred data which finally means high price of the service.

Key words: e-business, GSM, World Wide Web, WAP, SMS, Voice, HTML, mobile payment, mobile business.

Introduction

Intensive expansion of the Internet together with the networking of business companies lays a good foundation for further development of e-business. E-business is developing intensively therefore in certain areas of business conduction it plays a very significant role. Development of e-business brought in major changes in ways that profitable and non-profitable organizations conduct business. Some of the relevant characteristics which contributed to the importance of e-business are: ability to transfer large amounts of data across great distances, simple updates, availability, direct payment via the Internet, usage of advanced network infrastructures for specific services like the mobile phone payment of the parking service, Online banking, buying tickets for public transportation using a mobile phone and many other advanced services. According to ESPRIT-[1] (a project of the European Union) the following definition for e-business is used: "*Electronic business is a general concept which represents all forms of business transactions or exchange of data which is performed with the help of Information and communications technology (ICT). It refers to the business transactions and data exchange among companies, between companies and their customers or between companies and public administration. Electronic business also includes the electronic market of goods and services.*" One of the new forms of conducting business is the mobile business which primarily relies on the Global System for Mobile Communications (GSM). Mobile business represents one of the newer business models. Figure I. describes mobile business. Figure II. describes mobile payment through today's popular technologies such as WAP, SMS, Internet and integrated mobile phone applications. Figure III. shows SMS parking service conceptual scheme in theory and figure IV. gives an example of "m-parking" service in the city of Zagreb.

Mobile business

Mobile business is a part of electronic business based on the application of specific mobile technologies which give companies a market advantage in the mobility of workers and customers. This means that the workers are neither tied down to their offices nor to their houses. It also means that the consumers can order and pay for a product or a service from any place nation or world-wide with a single restriction - the signal coverage of their mobile operator. In the mobile business domain the following areas can be differentiated:

- mobile business communication;
- mobile marketing;
- mobile payment.

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[1] European Strategic Program on Research in Information Technology: http://www2.cordis.lu/ esprit/src/ecomproj.htm

Mobile technologies used in business purposes can be found mostly in the area of business communications which imply the exchange of SMS messages between the providers of the service and the consumers. Mobile communication among the employees is established via Intranet. According to a research conducted by the company Forrester Research[2] the most significant obstacles on the way towards development of mobile business are:

- concerns about the safety of transactions;
- possible previous bad experiences;
- ignorance about proper usage of technology.

GSM is the most widespread standard for mobile telephony used in mobile business. Mobile business represents the application of mobile technologies in business purposes, providing services, marketing and payment in order to improve business efficiency. Efficiency refers to lower expenses and to competitive advantage on the market. With the new, third generation of mobile phones (3G) which support better bandwidth a new palette of services became possible. The services can be classified into three categories:

- network services, which represent telephony through network administration;
- additional services related to the network like SMS, voice mail etc.;
- services related to a third party like mobile payment involving companies and banks.

Mobile payment

Mobile payments include all payments conducted with the help of a mobile phone, laptop or any other portable electronic device through network technologies and the Internet. Mobile payment can be conducted through the following technologies:

A) WAP protocol for data exchange in mobile networks
Wireless Application Protocol (WAP) enables access to internet services and content exclusively adapted for display on mobile phones. WAP has the purpose of transferring information so that it is adjusted to mobile users taking into concern the limited capabilities of data transfer through mobile telephony radio channels. It uses different forms of data compression in order to minimize the number of bits transferred through the wireless media. WAP applications include email, electronic marketing, online banking, transactions on the electronic market, information about phone calls, services, unified messaging, weather and traffic reports, news, information about sports, online file storage etc. WAP relies on Wireless Markup Language (WML). WML is a programming language optimised for the wireless transfer of data. The transfer

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[2] Forrester Research, url: http://www.forrester.com/rb/research

of data is based on the Wireless Transport Protocol (WTP) standard. WML shows the classical internet pages in a format which a mobile telephone can recognise and display on its screen. WAP as a communication language which enables mobile phones access to Internet services uses advanced wireless technologies of data transfer. Taking into account the speed of data transfer, mobile payment of services is preformed through the following data transfer technologies: GPRS[3], EDGE[4], UMTS[5] and HDSPA/ HSUPA [6].

B) Short message service

Mobile payment for services is also possible through the SMS service which is primarily used for textual communication on mobile phones. The SMS service means sending short textual messages through GSM standard for mobile telephony. The incoming and outgoing SMS message can contain maximally 160 alphanumeric characters. On its way from a sender to a receiver, the SMS message goes through the so called SMS centre, which is in reality a computer functioning as a server. The server has the function of distributing SMS messages to the end users and also ensures confirmation messages containing data about successful deliveries or delivery failures to senders.

C) Integrated applications for mobile payment adapted for usage on mobile phones

Mobile payment for services is also possible through internet applications and networks that are using Hyper Text Transfer Protocol (HTTP) and World Wide Web (WWW) service. A good example is the new version of a mobile operating system Android[7] (current version *2.3*[8]) which among its other features has integrated backup for mobile payment through Near-Field Communications (NFC). NFC is a chip that enables communication between devices within small distances. It makes paying bills possible using just a mobile phone and the appropriate terminal.

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[3] **GPRS** (General Packet Radio Service) enables data transfer and mobile access to the Internet, bandwidth up to 80 kbps.

[4] **EDGE** (Enhanced Data rates for Global Evolution) is a third generation (3G) mobile networking technology, enables data transfer and mobile access to the Internet, bandwidth up to 220 kbps.

[5] **UMTS** (Universal Mobile Telecommunications System) is a third generation mobile networking technology, enables data transfer and mobile access to the Internet in Croatia, bandwidth up to 384 kbps.

[6] **HSDPA** (High Speed Downlink Packet Access) and **HSUPA** (High Speed Uplink Packet Access) are upgrade to the UMTS network, enables data transfer and mobile access to the Internet in Croatia, bandwidth up to 7,2 Mbps.

[7] **Android** is an operation system specially adapted for use on mobile phones and other mobile devices like tablet computers.

[8] Current date: July 6, 2011.

D) Using laptops with mobile access to the internet network
Paying for services by using the Internet, the HTTP protocol and the WWW service is based on using Internet applications whose sole purpose is paying for services, for example PayPal. Taking into consideration the popularisation of the so called "smartphone" devices, which have reached a population of 600 million users world-wide with the growth tendency towards 1 billion by the year 2015, this way of paying for services, might compete and finally bring in new standards to the mobile payment service. In March 2011 Berg Insight reported that the global shipments of smartphone devices increased 74% in the period of 2009 – 2010.

Paying for parking using a mobile phone

In the present day there are many solutions in use for payment using a mobile phone. One of the main differences between them is the value added carrier which enables the payment service and also determines the way in which the service can be used. The carrier of the payment service by using a mobile phone can be:

- mobile operator (Vipnet, T-mobile, Tele2);
- the parking organiser (concessionaire) with his own solutions;
- banks which conduct business with the citizens (current accounts, credit cards);
- other companies specialised in paying with mobile phones.

Paying for a parking service by mobile phone can be made possible through:
- using a mobile phone – WAP;
- using a mobile phone – VOICE;
- using a mobile phone – SMS.

A) Advantages of paying for parking by mobile phone for users:
- Using the service without special need for check-ins or registrations and simpler and faster paying for parking;
- "Remote paying" – the user doesn't have to be in the vicinity of the vehicle in order to pay for parking or to extend his parking time. The user can pay for parking for any vehicle at any location (where the service has been introduced);
- "Reminder" – reminder about the expiration of paid parking time comes in 5-10 minutes before the expiration of the paid parking time;
- Availability of service - the service is available 24/7 which enables the user to pay for parking in advance.

B) Advantages for the concessionaires:
- Additional way of paying for parking – introducing this option of payment will make many drivers pay for parking more frequently and on time;
- Payment on time will decrease the number of parking tickets and by that the expenses of the concessionaires will drop;
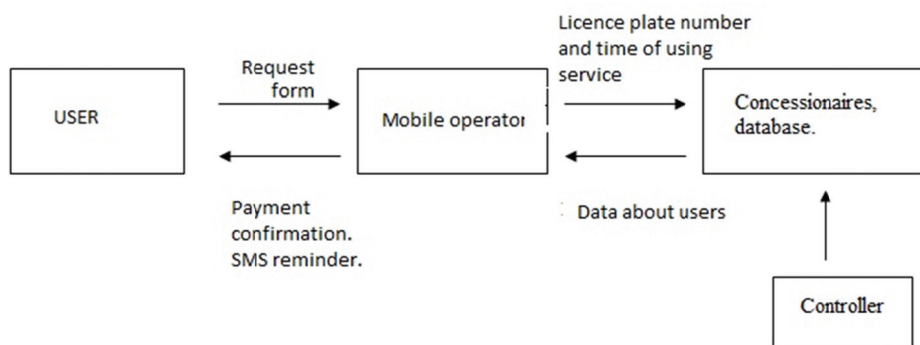- Decrease of operative expenses of the concessionaires.

Figure 1 - A Functional schema of an SMS Parking service

Figure 1 shows a functional schema of the SMS parking service. That means that user is sending request from a mobile phone using SMS service. SMS includes the exact form: car registration number like GS891BH (uppercase together connected). SMS is sending to a mobile operator number which forwards information to the database of the mobile parking concessionaire. I the same time, concessionaire server adds car registration number into the database together with other information such as start and end time using parking service. In the central concessionaire server, data is processed and put into separate databases for each parking operator. The data is then sent to the parking operators' servers so they can deal with any possible complaints from drivers. Also, on the basis of data obtained from the central concessionaire server, the parking operator is able to issue an invoice for all payments made through the mobile parking payment service. Table 1 gives technologies comparison for mobile payment.

Table 1. Comparison of technologies for mobile payment

Payment service	Advantage(+)	Disadvantage (-)
Short Message Service (SMS)	Compatibility of prices	Limited to 160 characters. The price of sending SMS message.
Integrated applications for mobile payment	Simplicity of usage, optimization for mobile phones	Compatibility with mobile operating systems, availability, price for using data transfer
WAP – pages adapted to the WAP protocol	Access speed, integration into the mobile phone menu, optimization for mobile phones	Limited display on the screen, price for using data transfer
Internet payment services (PayPal, e-gold, AlertPay...)	Total control of the user account (transaction times, services used...)	Demands an open bank account with deposited funding, obligatory registration, adapted for laptops and 'smartphone' devices

Charging for parking with the"m-parking" service

Most cities in the world have problems with the growing need for parking places. Segments of streets, which are generally public property, are used for parking and make living in the cities bearable. The development of the wireless communication systems technology and its application in everyday life enabled us to use mobile communications to pay for parking. Croatia started the charging parking by mobile communications service called "m-parking" in its capital Zagreb. The pilot project was arranged with only one mobile operator. Afterwards The Croatian Parking Association (CPA) developed a unified, unique system of payment and control of payment in all major towns in Croatia which had "m-parking", connecting the existing mobile operators into a system. Rapid development and application of mobile telephony created prerequisites for the application of modern technologies into the system of payment and control of parking. The penetration of mobile telephony in the year 2008 was approximately 75%[9].

Figure 2 shows a conceptual schema of the "m-parking" system – paying for parking by a mobile phone. Key steps in the process of charging for parking in "m-parking" are the following: processing requests, control over the parking payments and transfer of data between the concessionaires. The whole system is based on data exchange between mobile operators' servers, central server of the CPA and the servers of the concessionaires.

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[9] Source: http://www.t.ht.hr/press/novosti_disp.asp?id=1372 (accessed 14.4.2011.)
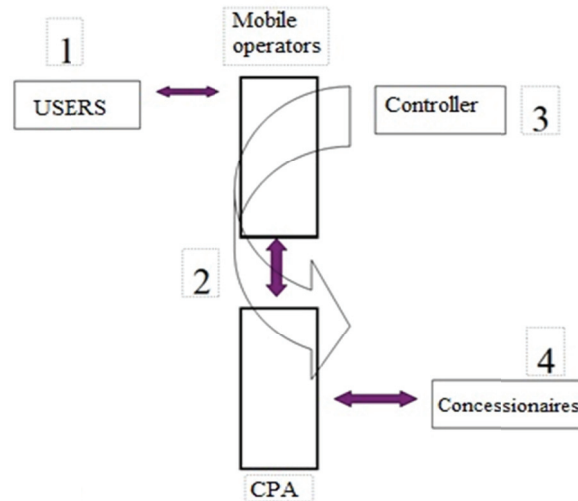
Figure 2. Schema of a conceptual solution to the m-parking service[10]

1-2 Requests processing
The central server of the CPA is connected to servers of the mobile operators. Servers of mobile operators forward SMS messages (requests) to the CPA server, which according to Regulations about payment and control of parking for individual towns sends confirmations (prices for parking along with the expiration time of the paid parking services).

3 *Parking payment control*
The central server of the CPA creates databases on a server assigned to provide data about the completed m-parking payments so that the controllers on the field can perform quarries about statuses of individual vehicles. A group of controllers for every concessionaire has access only to specific data which refer to payment for parking by mobile phones in their respective town.

4 *Data transfer: CPA – concessionaires*
In the central server of the CPA data is processed and included into separate databases for each individual concessionaire – member of the CPA. Data is then sent to concessionaires' servers so they can deal with the immediate complaints of the drivers. Likewise, based on data received from the central CPA server, the concessionaire is able to deliver receipts for all payments executed through the m-parking service.

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[10] Source: http://infoartgroup.com/wp-content/uploads/mParking-presentation.pdf

Conclusion

Popularisation of "smartphone" mobile devices opens doors to new possibilities in the mobile business development. The work on matching new technologies in practical use is intensive. The figures - 600 million "smartphone" users with the growth tendency towards 1 billion by the year 2015 speak for itself. The SMS payment service is introduced de facto as a standard in cases like paying for services like parking. One of the reasons lies in the simplicity of usage and lower expenses, but also in insuring compatibility with the mobile devices. "M-parking" service has lots of advantages for consumers but also have two main disadvantages. First, the price of sending an SMS message that has been determined in accordance with valid price lists of mobile operators (received messages are free of charge). Second, one SMS message only covers one parking hour. Using alternative methods of mobile payment service like integrated applications on mobile devices, NFC microchips, the Internet requires more time and transfer of larger amounts of data which finally means higher price of the service.

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