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Conceptual Model of Mobile Services in the Travel and Tourism Industry

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***Abstract*— Today, in a time of economic crisis, companies in all economic sectors should reevaluate their strategies to achieve the necessary market success. Recent studies show that the potential customers would rather spend their earnings on domestic equipment and electronic devices like laptops and mobile phones, than on vacations and traveling. This behavior generates huge losses for the travel industry and tourism. The potential solution for that problem is to connect the mobile industry with the travel and tourism in a way that will encourage customers to travel more and enjoy the time by using interactive and helpful content. In this paper we discuss the possibility of mobile device integration in the travel and tourism industry and its impact on potential customer groups. At the end of paper, a conceptual model of mobile services integration in the current travel and tourism industry is presented.**

***Keywords*—Mobile application, mobile services, social network, tourism, travel**

I. Introduction

MODERN technology is constantly changing the way of communication and interaction in different areas of human life. Miniaturization of electronic components and enhancements in transfer speeds of wireless transmissions has pushed the use of mobile devices to the almost every area of human life [1].

Web technologies based on user interaction in social networks, known as Web 2.0 are created around the idea that the people who consume media shouldn't passively absorb what's available, and rather they should be active contributors and co-developers [2]. Using new generation of mobile devices, it is possible to consume and change content available on the web from different locations and devices.

Hardware components are becoming more powerful, but less power demanding and in a few years the mobile devices could have the prime usage for everyday applications like reading, web browsing, multimedia and general information manipulation [3].

By popularizing technologies like social interaction and location awareness, a relatively new era in the modern business is becoming more and more evident. Those areas are based around using customer's location with all other information that could be gathered, for analysis and service providing [4], [5], [6]. These tactics are already being used by big advertisement companies like *Google* [7] which provide location-based advertisements to customers, targeting their location and interests [8]. With the radical impact of the mobile networks and mobile devices this kind of service providing will be even more evident in the future.

The emerging technology can be used in all kinds of different areas like finance, marketing, sales, transit and tourism. The focus of this paper will be on the last two areas — transit and tourism, because the potential use of the technology is huge and promises opening of the new possibilities in the sector that is currently spiraling down in the profit and market share.

Recent studies have shown that, while the economy is in the state of recession, potential customers rather spend their earnings on home entertainment systems and other electronic devices like laptops and mobile phones, than on vacation planning and traveling [9]. This behavior generates huge losses for the industry based on traveling or tourism in general. The potential solution for the problem is connecting the mobile industry with the travel and tourism industry in a way that will animate the customers to travel more and enjoy their time by using interactive or helpful content. That could be of benefit for both sides — the customer and the industry.

II. The Use of Mobile Technology in the Travel and Tourism Industry

A. Finding the customers

In the first place, the technology must animate the customer to think about traveling [10]. Nowadays it is not enough to motivate potential customers solely with pictures, souvenirs, tales of natural and cultural beauties and delicious culinary recipes. One of the things the Internet has brought is the outstanding multimedia and user interaction, which enables users to experience almost anything from the comfort of their home.

Online activities have advantage compared to the traditional offline activities. For many consumers, online shopping represents a more entertaining activity than the same activity done offline. They have a positive attitude towards the Internet advertising, which they perceive as being informative and up-to-date [11].

Interesting facts, questionnaires, games and viral advertising are a good starting point for the marketing campaigns. In

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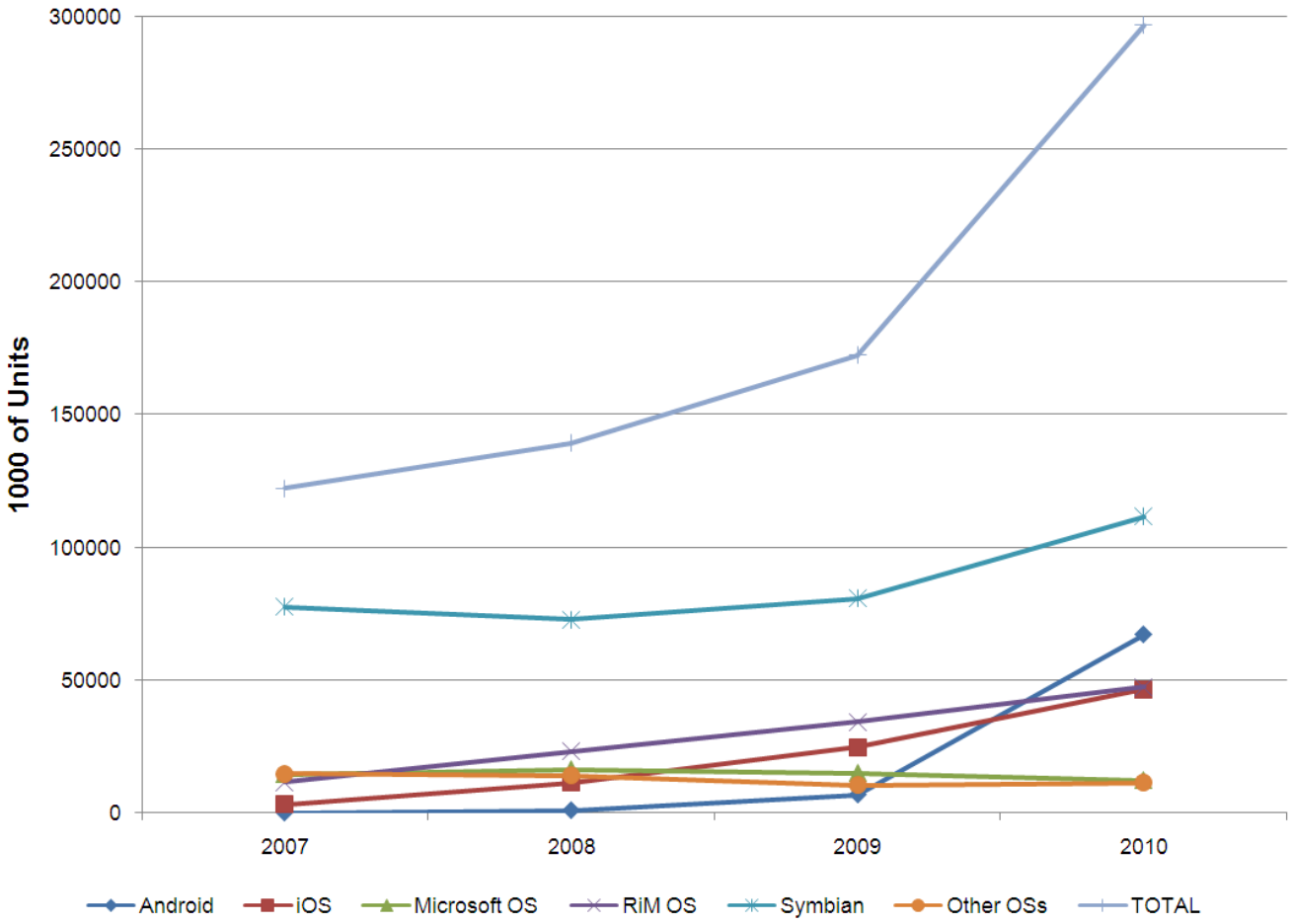

Fig. 1. Worldwide smartphone sales to end users by operating system

the last few years games and viral advertising — specially designed commercial concept relaying on fast, exponential information sharing through social networks (hence the name: Viral), have been the most successful tools in animating the potential customers into spend their earnings on the advertised products or services [12], [13], [14].

Usually, the questionnaires are more informative than games or viral advertising, but they can potentially cause the customer to lose interest very fast, so this sort of advertising must be well thought out, short, compact and targeted on specific customers [15].

This can be achieved by incorporating surveys within games or between multimedia contents, so the customers will not be able to ignore the content of the survey. The results of these questionnaires should not be considered completely reliable during the analysis and evaluation, although they could provide some input from the potential customer and subsequently be used as a measure of motivation for certain product or service.

B. Make them an offer they can't refuse

The mobile devices are the best gateways to the customer these days, because they are the most popular way of communication [16], [17] and make customers available at all times [18].

According to *Gartner* market research in 2009 [19] and 2011 [20], worldwide smartphones sales to end users is continuously growing. Smartphone sales to end users were up 72.1 percent from 2009 and accounted for 19 percent of total mobile communications device sales in 2010. Fig. 1 shows the trend of worldwide smartphone sales to end users in last four years.

Different operating systems changed their market position in that time, but in total, recorded sales have been growing steadily. The winner on the market of smartphones in last year are mobile phones based on *Android* [21] operating system which grew 888.8 percent in 2010 and moved to the second position in the top list of saled smartphones [20].

Many mobile applications and games are free and accessible to users through web stores and markets. Currently the most popular mobile application stores are *Apple's App Store* [22], *BlackBerry App World* [23], *Google's Android Market* [24], *Microsoft's Store* [25] and *PocketGear* [26]. They are open to the developers hence creating a bridge between customers and content providers, and in this way helping to spread the information about a potential product.

Customer can also be motivated by obtaining access to knowledge. Interesting literature provided in electronic compact form, specially designed for mobile devices could raise interest within certain user groups and spread the information to many potential customers.

Connecting with the mainstream media like the Internet news portals and blogs can be valuable for the success of the advertised product. Investing in applications specifically designed for the social interaction and content sharing is also essential for the potential success of the product or service, allowing it to be discussed and rated, which is beneficial for the future marketing campaigns and product placements [27].

Customer age groups and gender must also be considered. Misplaced or complex applications could have a great impact on a smaller group of people, but fail to have the desired effect on larger group of customers [28]. Applications or games must be relatively simple, considering that the elderly age group could potentially have problems with their usage. If the probability of reaching a larger group of elderly customers is considered important, then games and complex applications should be avoided [29]. Violence, inappropriate language and other questionable content should also be avoided.

Ergonomics of the mobile application must be considered as important as the content. Small screens can be very difficult to handle, so the design must be as ergonomic and clear as possible [30], [31].

C. Present options to the potential customers

When the interest among customers is awoken, the time is right to start the second stage of the concept, which is to take all the necessary preparations to present user with the lucrative options for spending their free time or vacation. Since the potential customer has already spent some time with the aforementioned content, it is possible to take action and analyze the data gathered from the user's actions. One of the solutions is to create necessary backbone system based on business intelligence and data mining concepts [32], [33] which will generate enough information to make a decision on what categories of the service should be offered to the customer.

If there is not enough data gathered from the potential customer, common data like user's origin, language, proximate location or patterns of web usage could be used to narrow the list of possible services that could be offered. Some of that data could be obtained from large Internet search engines or other services that offer that kind of information. Customer's proximate preferences can also be obtained by analyzing data from other customers living in the nearby area [34].

The last two options offer a part of reference data for the potential customer, but are much less effective and lack the individuality, and should be used only if there is no other way to gather information directly from the targeted person. Also, these solutions are less cost efficient because every piece of information obtained from large advertisement agencies comes at a price that could grow over time and create significant problems in the budget.

After the information is processed, it must be delivered and presented to the potential client in a way that will raise the chances of successful product reception by the potentially interested receiving side. That could also be achieved using games, multimedia or some other interactive medium like social networks. Customer wants more value for his or her money, and that must be taken into consideration. Because of the nature of today's way of life where almost one billion people own a mobile device that can connect to the Internet [35], tighter and more transparent link between Internet providers, media services and travel agencies must be established.

Internet and media providers possess the content that is very attractive to the customers traveling via travel agencies. First and the most important part of the chain is the Internet connection that has to be affordable to average customer. If there is no such thing as a broadband connection, no other processes can be considered. When traveling abroad, most users have the choice of using roaming Internet connection, but that can be extremely expensive and unaffordable for great majority of potential users. Other choices include using wide area WI-FI connections like ones in the big metropolitan cities like Paris, France or Berlin, Germany. Also a contract between travel agencies and mobile operators could be negotiated, so passengers traveling with the agency could have some benefits while connecting to mobile operator's network, without roaming, or with roaming but with special, lowered prices per data unit.

D. Keep track of customers

If customer chooses to purchase the presented offer, interaction between the tour operator central server and customer's mobile devices could be used to help or entertain the customer in a number of different ways. If the customer buys complete travel package including airplane transport, transfer from the destined airport to the hotel or apartment and sightseeing tours, it is possible to provide them in real-time the latest weather forecast, information about airplane delays, bus stops and other important information.

The customer can be led from the moment when he or she leaves home to the moment of arriving back after a trip or vacation.

In the urban areas, location-based data could be used to expand the mobile device services. Location-based services make use of a device's integrated Global Positioning System — GPS components to get the user's current location. The latitude and longitude of the customer/device is usually determined using some sort of positioning service like satellite-based GPS – currently, the only global positioning system in commercial function [36].

In the future, devices could be using another type of global positioning system like the Russian *GLObal NAvigation Satellite System* (GLONASS) – ex-military system, but currently open to public [37], Chinese *Compass* navigation system [38], [39] and the European Union's *Galileo* positioning system [40].

Some microchip manufacturers like *Broadcom* [41] or *Qualcomm* [42] implemented the support for multiple position systems in their chip architecture to achieve more flexibility in global markets, especially in Russia where the government confirmed a plan to introduce 25% import duty for all GPS devices without support for GLONASS by 2012, as part of efforts to encourage worldwide adoption of that technology [43].

Current GPS modules integrated in modern mobile processors provide enough accuracy to be used with the mobile applications interacting in a way that makes it possible for the customer to be lead in almost every situation.

GPS positioning is less suitable for use in urban areas because of the significant signal loss, which is attributed to signal bouncing of the walls of tall buildings block (multipath propagation), which can cause inaccuracy in positioning results. Bad weather conditions also contribute to signal degradation. Weak signal contributes to significant delays in precise signal acquisition.

Better solution for calculating the mobile device's position is with the help of the network-positioning approach. This concept, also called Assisted-GPS, or A-GPS [44], is integrated into most mobile devices today, and uses the help of mobile network tower cells to calculate geographical position faster and more accurate.

Cellular network towers can provide user's device with additional helping parameters as:

1) Orbital data with current satellite positions.
2) Position recalculation from the gathered GPS data snapshot received from the client.
3) Approximate location of the customer using the network multilateration which narrows the GPS position to a smaller geographical location.

If there is no GPS signal to accurately determine users position, most common solution is based on the network multilateration based on signal strength received on three or more mobile base stations [45]. This concept can narrow the radius of the customer's approximate position up to 50-70 meters, depending on number of network towers and terrain architecture.

E. Take care of customers' needs

If there is a travel delay, customer could be presented with a choice to purchase some sort of interactive or multimedia entertainment like mobile IP TV or video-on-demand. But if the flight is to be canceled or delayed for an uncertain period of time, customer should be alerted and presented with the list of choices like booking a hotel/apartment or contacting the taxi service. On some flights, customer is offered with an option to purchase WI-FI Internet connection during the time of the flight so travel agencies could team up with airline companies and create special offers that could also be a part of the travel package [46].

If customer is traveling by airplane, transportation from destined airport sometimes is sometimes not included in the purchased package. In that case, customer using the mobile application can contact the taxi service, or he or she can be informed in detail on how to reach the destination. Timetables for buses, trains or metro transportation could also be provided, as well as prices and categories of tickets. If the customer has a device with location awareness, such as GPS-enabled device, a detailed instructions could be provided leading them across the points of interest.

The relatively new concept in development of mobile applications called augmented reality is similar to fighter jet pilots head-up display. In this concept the mobile device camera, electronic compass and GPS device are connected together via software platform creating advanced visual experience [47]. On mobile device screen the actual image captured with the devices camera, data about current direction and position of the device analyzed via electronic compass and GPS coordinates, are mixed with the information about the environment and surroundings gathered from the Internet. All of this is presented on devices screen in a compact form allowing the customer to have the synthesis of right information about the surroundings in real-time.

There are many visually or hearing impaired people who are willing to travel and can be potential customers. Many of them have difficulty finding their way, frequently feeling disoriented and even isolated. Despite their impairments they also are potential customers for travel and tourism companies.

There is a number of navigation systems developed for visually impaired people, and some of them can provide dynamic interaction and adaptability to change in the environment. Outdoor navigation systems are generally based on GPS. They can locate and track the user and give them up-to-date information about routes and rerouting according to changes in the environment. That system should also be able to give information about nearby signs [48], [49].

In an indoor environment, such as airport building or museum, orientation is more difficult because of the confined space with many obstacles like stairs, doors and furniture [50].

Next logical step is to adapt hardware and software of the mobile devices to the level that is comfortably usable to the people with the special needs. For hearing impaired people design should be based around visual interaction, and for those visually impaired, design must have more audio and tactile stimuli, such as screens capable of displaying Braille alphabet.

The application should be at customers hand at all times during the trip, providing current information about historical monuments, museums, bars, clubs and other attractions [51], [52]. Customer's gender, age and budget should be considered when offering points of interest. This information could be gathered right on spot through the application, or could be extracted from the data collected from the customer before he or she decided to book the trip. The first option is a better choice for customer and travel agency, because it enables more accurate results for places worth visiting for the customer, and more detailed information about wishes and patterns of behavior, for the travel agency. This data also allows better choice to future travelers so they have more options presented

even before they arrive at destined location.

The application must have an interface with the most popular social networks like *Facebook* [53] or *Twitter* [54] so the user can share the experience with friends or followers. Users rating should also be implemented, and he or she should have possibility to evaluate/rate service, accommodation, visited places etc... That information could be shared between other users and travel agencies making the service better and more advanced.

The trend today, especially with the younger population is avoiding travel agencies and turning directly to web enabled company services for finding flights and accommodation. In that way younger people feel more free and unbound by agency-created itinerary and can travel with significantly smaller budget than with the common options presented by the agency.

This group of potential customers should not be neglected since it is a great target for offering a mobile application that could help them plan the travel their way. For a small amount of money they could purchase an application that would offer the best way to plan a trip to the wanted location. The quantity of purchased applications by users could largely surpass the funds spent for creating it.

III. Conceptual Model of Mobile Device Integration

Conceptual model of integrated mobile services presented on Fig. 2 consists of three essential parts:

1) Mobile application.
2) Enterprise architecture consisting of cloud based SaaS (*Software-As-A-Service*) which is business-oriented part of the application.
3) Decision support system for business intelligence and information gathering. Information is generated via multiple sources, mainly Internet related.

Goal of the presented architecture is to provide synthesized information from different sources, protocols and technologies that can be found on the global network.

The center of the architecture is a user (#1 on the Fig. 2) carrying a mobile device able to connect to a wireless network. Using application developed for that device the user can communicate with the cloud based architecture owned or leased by a network operator, travel agency or some other enterprise industry subject. The user can also be a source of information providing feedback via mobile application itself or through blogs, webcasts, reviews, social networks or other Web 2.0 communication tools. Described system would not be based only on feedback from one user, but on massive amount of data gathered from the Web (#2 on the Fig. 2). This data could come from blogs, podcasts, forums, reviews, frequent web searches, news portals, social networks etc...

Because the number of users connected to the Internet grows linearly every year [55], today almost two billion people have Internet access [35]. The amount of data on the web increases by approximated 10% yearly [56] nearing 50 billion unique

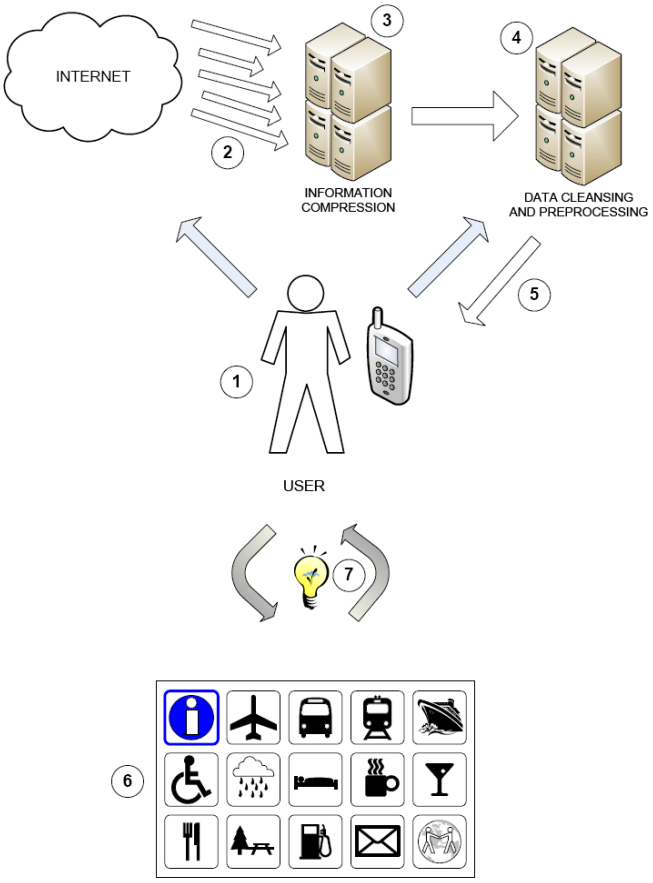

Fig. 2. Proposed system architecture

web pages in 2011, and it is extremely hard to extract useful and precise information from the Web content. These statistics include only data gathered from the number of pages existing online, but the Web consists of many information sources that are constantly changing, or are in a format that could not be described as a web page, for example, social content and multimedia, both containing valuable information about the behavior of Internet users.

To be able to analyze so much data, nontraditional approach must be considered. Analyzing data in detail, one at the time would be time-consuming, resource demanding and virtually impossible. The technology that could provide synthesis of content is based around fuzzy linguistic agents, semantic clients and neural networks [57], [58].

Process during which data of interest is gathered from the Internet is called content acquisition. To be able to distinguish between small amount of interesting and large amounts of potentially uninteresting data, a selection must be applied. Data selection is enforced with the help of the customer profile database. This database can be created via customer's interests gathered from aforementioned questionnaires or with the help of the data gathered from the social networking sites.

This process leads to knowledge creation from which the set of relatively strict rules of content filtering can be created and inserted into the customer profile database for filtering the content in content acquisition phase [59]

Implementation of this technology would gather precise information based on a set of rules, and produce approximate values in synthetic form, compressing large amounts of data (#3 on the Fig. 2) to only crucial information that could be used by the client or the enterprise software owned by the service provider.

Synthesized information can be further processed (#4 on the Fig. 2) by the process called data cleansing and preprocessing [57] in which incorrect data is ignored and correct data is saved to the data warehouse for further analysis. Data obtained in this step could be connected with the offerings from advertisers in partnership with service or application provider, so the end-user (#5 on the Fig. 2) gets the detailed information with helpful hints combined with the latest offerings from the business partners.

Ranking of the most interesting results must also be considered to be important issue. Although the final results are synthesized, there can still be significant amount of information that complies with the rules defined from the user's interests. Location could be used to help ranking the results, with the offers closer to the user's location positioned on the top of the presented result.

The user can be interactively forced to make the selection between two or more additional options and the result of the chosen option(s) can be used to narrow the search and display of the results.

For example, if the user wants to book hotel or private accommodation, he or she could be faced with the big set of results, although the data has already been cleaned and synthesized. To narrow the search to a smaller set of data, user can be presented with the set of choices like accommodation special offers, category and type, relative distance from the user's current location, view etc...

Commercial side of the result ranking should be considered if significant amount of financial resources is gathered from the advertising. The paid advertisements could be placed on the top of the presented results or marked for greater visibility. Google presented paid ad ranking concept in which the commercial companies go through bidding and competing process to reserve the better ranking in search results.

The information received by the user (#6 on the Fig. 2) can be divided into two types:

1) General helpful information about places, tourist attractions, means of transportation etc..., which is essential for user to enjoy the trip.
2) Special offers, such as current business and service offerings by the partners and advertisers, making the user's experience potentially even more enjoyable.

Fig. 3 illustrates an example of the user interface.

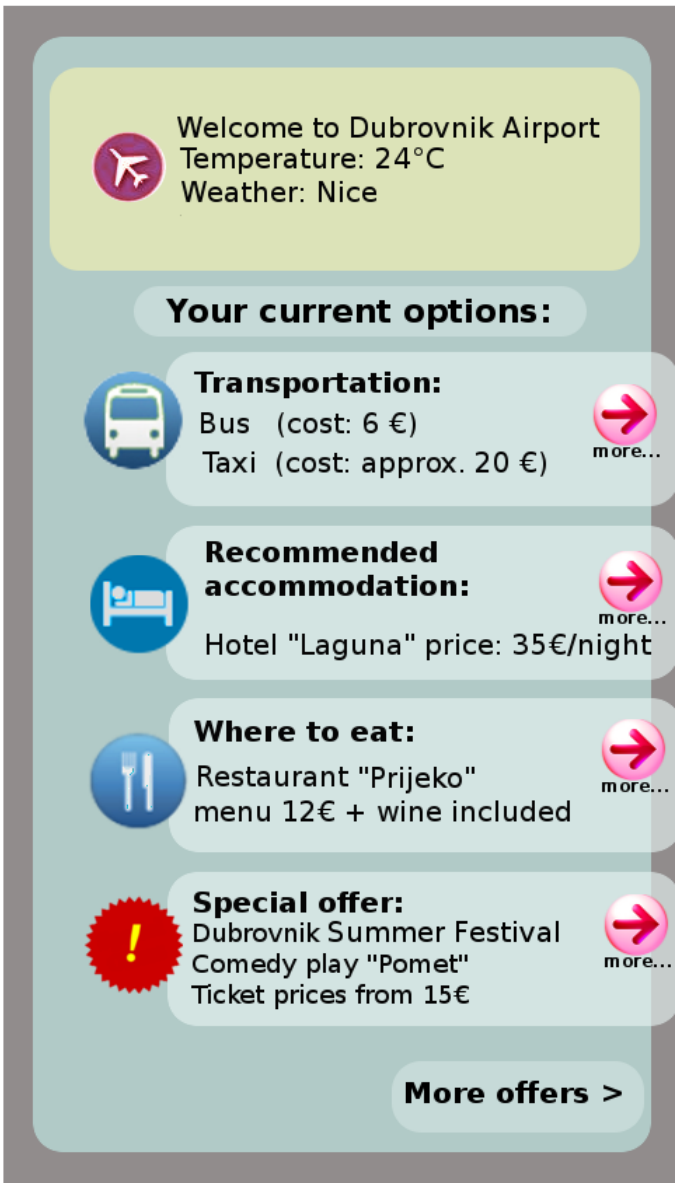

Fig. 3. Screen of application

IV. Conclusion

Mobile services and web application world is emerging very fast, and in a couple of years they will have a significant value in the market share, maybe even surpassing the use of desktop applications. This will have a huge impact in every area of economy, technology and service industry.

Companies who adapt to fast growing mobile market will have a significant advantage over those who fail to act fast and adapt quickly. A number of companies that have realized the power of mobility and web interconnection have already created advanced mobile services and applications and have made significant profits, increasing their market shares. All this can be applied to the travel and tourism sector too, making it more modern and more profitable.

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