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ICTIC is dedicated to the theoretical foundations of Informatics and Management Sciences and provides a forum for researchers and scientific interaction in areas such as Computer Science, Applied Informatics, Management and Marketing, Economy, Business and Financing. All processes and committees, established in this conference, move the ICTIC forward into acknowledged Scientific forum. Therefore we would like to thank all members of mentioned committees, partners supporters and organizers for their contribution.

With best regards



doc. Ing. Emil Kršák, Ph.D.

*Dean of Faculty of Management
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The model of system for marketing promotion based on user location

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Abstract - Location-based services with the proper application are the powerful marketing tool, which allows direct advertising and searching based on the current location of the user in real time. Location-based system, called Shopping City, is a system, which would allow the movable user (in this case the buyer) to be able to select the desired information and transparent delivery and display of the content on the terminal, and to the suppliers of the product or services direct advertising upon request of the customer or consumer. The system easily connects supply and demand in a particular area of only those products and services, which at the time the user wants and needs. As a result, the system would in a simple and stylish way shorten the search time of a selected product or service, and would allow the supplier with direct marketing to target customers.

Keywords: location based services, marketing, information and communication system, mobile application

I. INTRODUCTION

In recent years, market analysis and forecasts were giving very optimistic results to assess the commercial importance and acceptance of location-based services among users. However, recently were established important facts regarding the location of services, and that is that information about the location as such are not a service that can be sold, that is cost-effective. Position information is valuable, and therefore cost-effective, only in the package with the service requested by the user [1] [2]. Information about the position can be very well used in filtering relevant information with search results of the Internet search engines [3]. This procedure provides immediate value to display only those search results that are relevant depending on the position of the user [4].

Systems for the delivery of location-dependent content to mobile users in practice has been performed for some time now with various objectives dependent on the information that are offered to users. The market is filled with systems for information about the weather forecast, nearby ATM machines, the nearest gas station or the nearest restaurant [5] [6] [7]. However, during the design and development of the topics it has been noticed that only selling points were typically represented, but not the products and services. So, if there is a demand for a particular product or service it is necessary to know which selling point particular product or service has to offer [8]. This makes the whole process more difficult for users. In response to this problem the idea of filtering options of the certain product or service looked like a good idea, so the

result of the search would answer which stores, outlets or selling points meet the particular query [9].

Basic location service is just locating terminal. However, locating itself will not satisfy most users. So such services need to introduce additional functions in order to achieve services with added value. The user wants to provide information that will be closely related to the location of the target terminal, and as specific as possible to the user. Only such service the user would evaluate as satisfactory and high quality.

Three parameters define the quality of location-based services (LBS):

- The accuracy of locating - which imposes the very nature of services. Normally the accuracy would be defined in the appropriate interval and with the minimum allowable accuracy. In any case, the intention is to achieve the greatest possible accuracy.
- Keeping anonymity of users - at any location services the users must to some extent "sacrifice" part of their anonymity. In addition to preserving the anonymity, there is also the question of unauthorized tracking of a person by following of the mobile terminal device (MTD). Specifically, it is unnecessary to emphasize that it is undesirable to us to be followed without our knowledge. For all these reasons it is necessary to protect the user's location with the appropriate security mechanisms.
- The usefulness of the information provided - this parameter is most visible in the information services because their main purpose is to provide content. This means that the user will not evaluate the quality of service if he gets the content, which was not wanted or requested, or lack the interest.
- Observing the parameters of service quality leads to the conclusion that the quality of services is the result of the relations of three earlier mentioned parameters. Specifically, if the user wants to have complete anonymity, he will, of all above services, choose the service of cell broadcast. In this case, he will not be able to filter content so will lose the parameter of usefulness of the content. Also locating will be restricted to the size of the cell. In this sense two marginal services can be mentioned. The first one is cell broadcast service which offers to the user almost

complete anonymity (similar to usual usage of mobile phone anonymity), but it provides him with very poor information and mediocre precision of localization. The other extreme is monitoring services, which can locate very precisely. At the specified precision is also based the information provided which in this case is very high, but at the same time the user completely loses the anonymity. This implies that the service should be developed so the optimal ratio of the above three parameters would be kept [10].

II. LOCATION-BASED SERVICES AS AN INSTRUMENT IN THE MARKETING PROMOTIONS

Promotion as an instrument of marketing mix encompasses all activities between companies and customers aimed at creating a positive attitude about products and services, sales promotion or acceptance of ideas. For example, enabled by mobile technologies and location-based services, companies can use customers' location information to improve their promotion strategy and select targeted customers [11]. One of the ways to spend such promotion is location-based advertising (LBA) [12]. LBA is a form of advertising that integrates mobile advertising with location-based services. The technology is used to detect consumers' location and provide location-specific advertisements on their mobile devices. LBA refers to marketer-controlled information specially tailored for the place where users access an advertising medium [12]. The promotion is effective only if other instruments (product, price and distribution) effectively carry out their role. It cannot compensate for weaknesses in the effectiveness of other instruments. Promotion is a way of communicating with the company's customers. With the development of mobile communication, LBS have become a new means of communication and promotion [13].

Communication is defined as the transfer of information, exchange of ideas and the process of establishing a common mind. There are five basic components of the communication process: sender, receiver, medium or channel, message and feedback. Figure 1 shows the communication process in the promotion where is visible how the sender's and the recipient's experience may not necessarily be the same. It is often the case when the sender of a message encodes in a way that the recipient can easily decode. In this respect the feedback is of great importance in marketing.

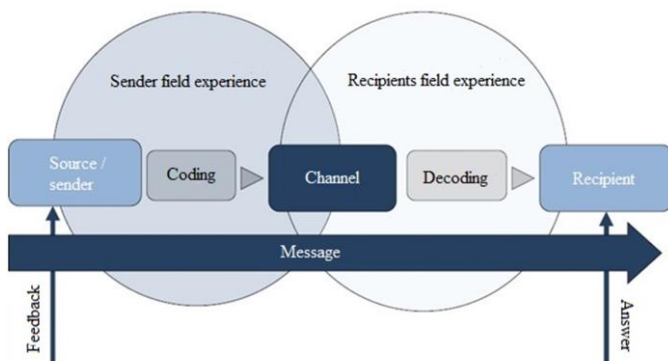


Figure 1. Communication process in the promotion

With the development of mobile networks and related technologies, the new possibilities of services in wireless environments with mobile users, are available [14]. Examples of such services are location services, which have, in recent years, experienced rapid development. In the beginning it was a simple location services guide, while today LBS integrate with the Web services, to give, to a large extent expanded functionality [4] [7] [15]. Furthermore, by combining LBS and social networks (eg. Foursquare) this development has led to the growing interest in location-based social network (LSN) marketing and the recognition of its importance for local businesses [16].

According to a survey conducted by the Pew Research Centre in America in February 2012, almost three quarters (74%) of smartphone users use location-based information in real time via their smartphones, while in May 2011, the same services were used by 55 % of smartphone users. The increase comes because more and more people own a smart phone. (While in 2011, 35% of adults owned a smart phone and in 2012, 46% of them owned a smart phone). Measured data show how within the specified period of less than one year the use of location-based information in the adult population almost doubled, from 23% in May 2011 to 41% in February 2012. At the same time, more and more owners of smartphones use geo-social services such as Foursquare or Facebook to "sign up" in certain places and share information about their location with friends. 18% of owners of smartphones use geo-social services via their phone in February 2012, while in May 2011, the same services were used by 12% of the owners. It says that 10% of the adult population use geo-social services in February 2012, compared to 4% in May 2011. Almost all users of geo-social services, 93% of them, publish information about their location to their friends. [17] [18] The study shows a remarkable upward trend in the use of LBS, and it is expected even more. Further disclosed system aims to exploit this potential and connect supply and demand based on the current location of the user in real time [19]. Provider of mentioned services through the above-described system is called Shopping information Service Provider (SiSP).

The paper presents the conceptual, logical and physical operation model of the system intended for real-time marketing promotion based on current user location, which is called Shopping City System (SCS). For example, SCS is intended primarily to customers and consumers of various products or services in order to facilitate the search for products or services. On the other hand the Shopping City mobile application (mSC) is a powerful tool of advertising and is therefore intended for the various bidders of these products and services (SiSP). Take for example that the potential buyer is in town and up to buy a shirt. He registered via mobile applications on his MTD in SCS and chose the following parameters: shirts, men's, credit card payments in instalments, close to the point of sale to 500 meters from its current position. The system offered him all potential stores that meet his request.

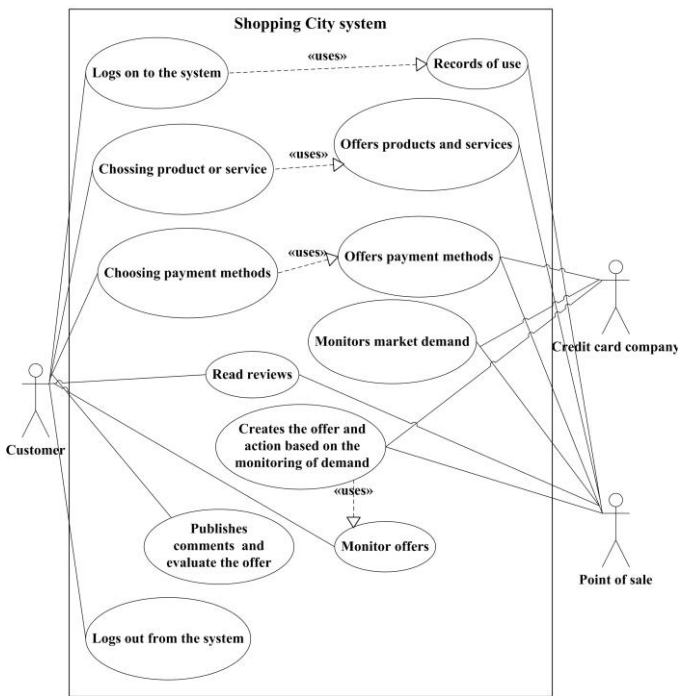


Figure 2. Use case diagram of Shopping City system

As the buyer move through the city so the requested distance of 500 meters is moving along with it, and the mSC informs him about the new stores that, given the current position, are again located within the given area, and meet the required criteria of the user. By logging out from the SCS user will no longer be offered the required content (Figure 2). On

the other hand stores have the option of direct advertising to the potential buyer and at the request of the customer. In order to advertise for sale via the SCS, the content of their tenders must be submitted to the SCS administrator or filling out a Web form through Shopping city Web application (eSC) and regularly refresh to real-time so the information would be accurate. Advertising of their offer through SCS stores pay directly to the manufacturer of the applications and in this way the whole project has been funded (Figure 2). From third-side the system could be interesting to credit card companies, which in cooperation with retailers would also get the opportunity of direct marketing towards the customers. Considering that today credit card payments are much more common form of payment than the classic cash payments, through the SCS, credit card companies have an additional medium for advertising their services (Figure 2).

III. SYSTEM FOR ADVERTISING AND SEARCH OF PRODUCTS AND SERVICES BASED ON USERS LOCATION - SHOPPING CITY

Location-based system SCS works on the principle of client-server. In this way the problems related to limitations of the possibilities of MTD as well as the problem of traffic over a wireless connection are being avoided. There are two sides of communication (Figure 3):

- Client - MTD
- Server - fixed computer

The client performs only basic tasks, specific to the client and his location. Demanding data processing and supplying of the content is performed by fixed computer - server. This essentially unloads the client device, which was the original goal. The topological architecture of the system is developed

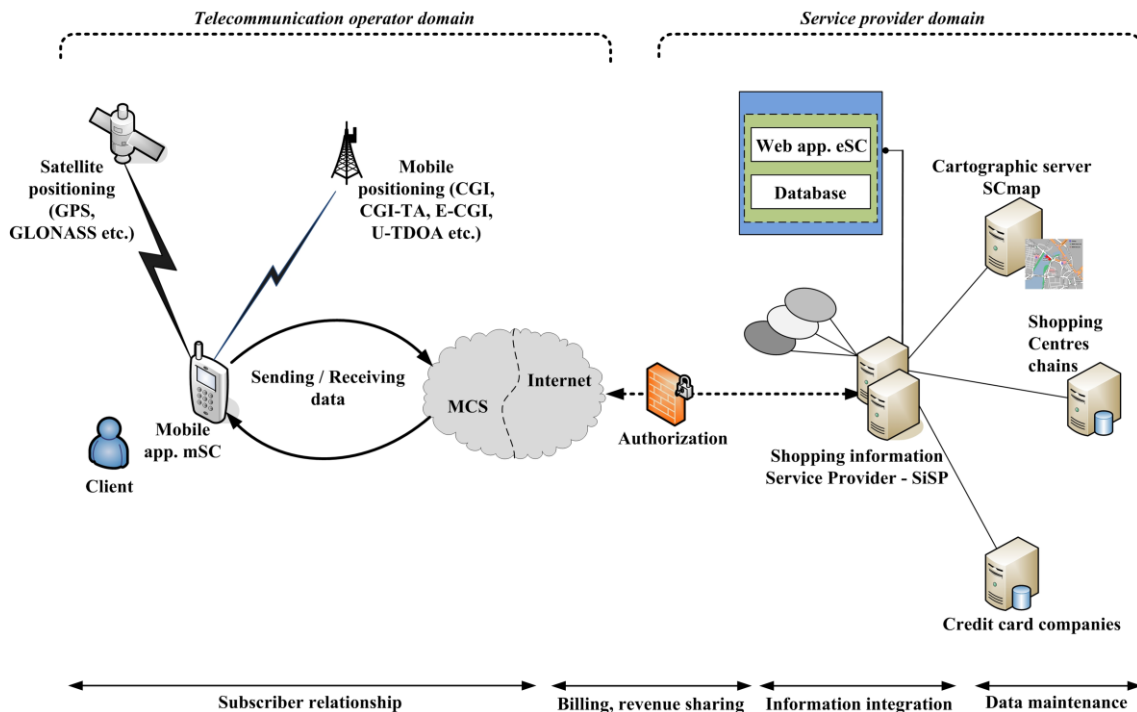


Figure 3. Topological architecture of the Shopping City system and LBS Value Chain

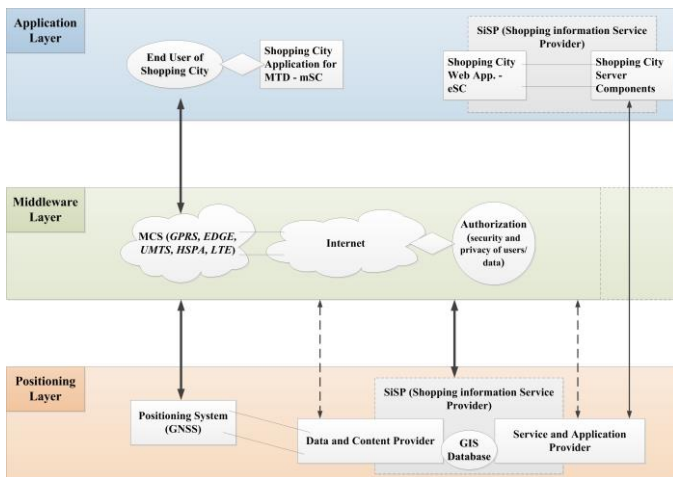


Figure 4. Reference functional architecture of communication model - Shopping City system

and shown in Figure 3. However, even if that communication was functionally location-based applications it must overcome several challenges of technological nature. Technologically, the realization of LBS can be described as a three-layer communication model that includes the following layers: Positioning layer, middleware layer and application layer [20].

Positioning layer is responsible for determining the position of the MTD or user. This makes by Position Determination Equipment (PDE) and geo spatial data stored in the Geographical Information System (GIS). While PDE determines the position of the device in a network sense, GIS allows the conversion network in geographic information (latitude and longitude). The end result is the forwarding of the results obtained through the Gateway directly to Application layer or Middleware layer.

Middleware layer is necessary to ensure a simple way of connecting the network infrastructure operator (MCS) with GIS data (vector and raster maps, aerial photographs, geocoding and reverse geocoding) and LBS application layer, and allows the tool to protect the privacy and anonymity of users in determining their location.

Application layer allows application logic to all of the services that use information of location of the user, perform processing and display position information. Figure 4 shows the referent functional architecture of communication model of SCS.

In this case, the wireless link transmits small amounts of data. The client must transfer parameters of the server, and he must respond by sending the requested content.

The service consists of client and server applications that communicate with TCP / IP (Transmission Control Protocol / Internet Protocol) protocol. IP connection extends from end to end, or from a server on the Internet to the end user, the MTD. How in the access part of mobile networks (MCS) is a wireless environment, the IP connection is provided by GPRS (General Packet Radio Service), EDGE (Enhanced Data Rates for GSM Evolution), UMTS (Universal Mobile Telecommunications System), HSPA (High Speed Packet access), LTE (Long Term

Evolution) or by similar service. For the purpose of locating the terminal A-GPS (Assisted Global Positioning System) positioning methods are used. This method can determine the most accurate current position of the user and location of stores that match the desired search criteria. It is possible to use other GNSS (Global Navigation Satellite System) solutions, for example determining the position via system GLONASS. The client application has the task of determining the exact position of the MTD's. Once the client application shows his current position a connection to the remote server TCP / IP protocol has been created. In Figure 3 we see two TCP / IP connections. The first part refers to the connection in the wireless environment. The second part of the link is fixed TCP / IP connections follows after nodes SGSN and GGSN, which are in a fixed part of the IP network. In this way TCP / IP connections from end to end has been secured. After establishing a TCP / IP connection, the server can send the parameters necessary to carry out the service: the current position of the user, the requested content and features screen MTD's. After the arrival of the application server determines what type of content the user is looking. Then it retrieves the requested content from the database, process it in order to efficiently present to the user terminal and then sent to an established TCP / IP connection.

A. The client

The client represents a user who has, over MTD with a pre-installed mSC application which is a part of a SCS, submitted an application for LBS. The client in this case must have a smart MTD (smartphone) that is equipped with a GNSS receiver (GPS, GLONASS, etc.) as well as a reliable connection to the Internet. The GNSS technology has been used because it is the most accurate in determining the user's location and stores corresponding to the requested query. Application mSC for MTD on the user's request for LBS service initiates the positioning of user and sends after a short treatment by applied communication technologies of the mobile operator to server computer, which will receive it and further process in accordance with the appropriate application. Once the server has processed a request, the resulting data are being sent back to the user and based on its position, in the form of answers on map, shows all locations that meet the required criteria.

B. Server

On the Server side is a domain of SiSP. Server is a computer that performs all the necessary actions, processes the data, adapts them and sent them back to the user for display on a MTD. In the first step of communication with the client, the server accepts the user position coordinates (x, y) as well as sets the search criteria defined by user, according to which the search of the database starts. All that is performed by a program script, which acts as a mediator between the server and the database. Its task is to adjust all the necessary data to be sent back to the mobile terminal. After processing the data and obtain answers for the search query about locations which meet the required criteria, the map has been determined which is then sent back to the user for a visual display of all the nearby stores and for the better customer orientation. The system uses the Shopping City maps (SCmap) e.g. Google Maps service. The server then sends the mapping service (in this case Google

Maps service) request in the form of user coordinates and on that basis receives a response in the form of raster maps. Since the user has by registering to SCS allowed the input of new content to suit the required search criteria, the server communicates with the client throughout the duration of the open session between the client - server and continuously processes the data considering the current position of the user.

C. Web application Shopping City

Web application eSC aims to register all the nearby stores, which wish to advertise through SCS. In addition to registration, stores via Web form on eSC fulfil data related to their offer where they provide access to basic information and some additional attributes for the offers advertised, all with the goal that the user (client) who sends a request for LBS, get the most precise information and insight of the desired products. Finally, the data store location associated with geographic data from the database [21].

D. Database model of Shopping City system

The type of information that is related to the stores is mostly correlated with the location. It is necessary to have a good database model that is dynamic, flexible and scalable and is regularly updated either via a Web form on eSC or by the administrator, because of the efficient search database records. For each outlet the following information are important:

- Unique identification number (ID) - allows easier identification of the store and reduces the possibility of errors
- Location - is used for geo-referencing, integrating the ad with a location on the Earth's surface
- Type of product or service - is divided into: Fashion, food, equipment, accommodation, etc.
- Methods of payment - cash or credit card, or a one-time payment or in instalments

There are additional attributes as well which describe a particular store for the purpose that the user can narrow down the search as precisely as possible.

E. Cartography

The mSC application for MTD uses raster maps that are sent from the server to the MTD. They are rectangular in shape and are part of a much larger mapping system, but due to limited performance and memory resources MTD segments it into smaller parts. Since the screens of MTD are in smaller dimensions, the user must be able to move around the map by using the navigation keys. The user position on the map is displayed on the MTD in the middle of the screen for easier reference.

F. Mobile application Shopping City

The work of mSC application is based on a simple and intuitive use. The goal is to enable the user that in fewer steps reaches the desired results.

Immediately after starting the application and registration to SCS, the user is lead to the main menu where the user selects the desired category of products or services (fashion,

technology, gastronomy, entertainment...), the payment method and the required maximum distance from the store:

- The category of products or services - fashion, technique, Food, Entertainment, etc.
- Methods of payment - cash, card, once, in instalments
- Maximum distance to the store from the current positions

Each category is further branched to additional subcategories within categories so for example in fashion, may be further narrowed to the search for clothing, footwear and fashion accessories (Figure 5). Furthermore, selecting the new attributes such as jacket, shirt, pants, sweaters, etc. can further narrow the clothing. Depending on how the user narrows the choices so will also be as many answers to narrow the number of stores, because if the user selects only category Fashion, the screen will show the stores with clothing and footwear. If at that moment shoes are not the priority, it is enough to further narrow the search.

This is followed by the determination of the location of the user via the GNSS. When the position is determined, the

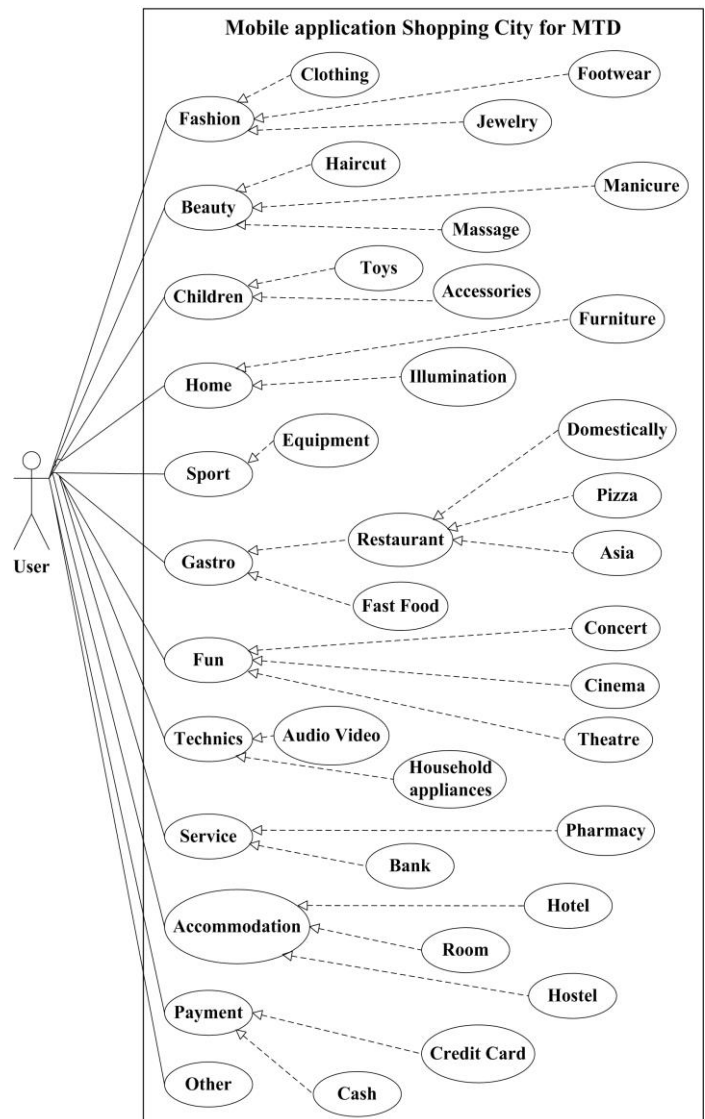


Figure 5. Use Case diagram of mobile applications Shopping City for MTD [15]

coordinates along with the search criteria are sent to the server for further processing. Based on the received data, a program script on the server performs the necessary actions and sends back the data and information in the search results to find the MTD. This information is related to ads of certain stores, which are near the user based on certain positions, i.e. alleged GPS coordinates. Case of the usage of mSC, and the possibility to choose the content of the application is shown on Figure 5. If necessary, all the attributes may be further expanded. The search results are shown on MTD. For easier orientation, the SCmap is set in such way that the users' position is in the centre of the screen of the MTD. For each of the ads displayed, the additional information is shown. Each ad is numbered according to the distance from the user's position.

IV. CONCLUSION

LBS by using mobile telecommunications infrastructure submit to its users the required data and information services depending on where the users are. Location based services can be seen as a combination of new information and communication technologies which include mobile telecommunications system, technology for positioning, GIS and spatial data base. Besides these technologies, location-system consists of services and service providers and service providers of content.MTD, usually in the form of a mobile phone, allows the user to send requests and receive the requested information and services through wireless communication networks. The main input data during the request processing is the exact position of the user who has requested a particular service. Today most of the MTD for positioning uses the GPS receiver, primarily because of its accuracy and reasonable prices. On the other hand, the basic element for LBS is considered a GIS used for the management, processing and delivery of spatial information that is stored in the appropriate database. Providers during the processing of the application of the user performs a database search, locate objects of interest, shortest path, defining ways to navigate to the object, etc.

The use and benefit of the location information in traditional and new markets will become more and more present. Mobile operators will find themselves facing the challenge of how to ensure the most of the markets in the field of LBS. At the same time, independent developers are helping traditional industries to improve the value of their products by benefiting from the information available on the site. The SCS in its core uses all system stakeholders, end user or consumer, retail outlets and credit card companies, each in his view of the market. Because the SCS is in the conceptual stage of development, and as such has not yet come to life the final check would be qualified after the system is operable and used by end users for a specified period of time. Therefore, the system opens up a whole new medium of advertising - advertising using LBS to the client's request. This is a generic system and can be developed and modelled to cover only a certain part of the market like Gastro, Fashion etc.

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