The Use of Web Application “Mobilne Miasto” [Mobile City] in the Conveyance of Information About Urban Space in the System Human Factor – Technology

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ABSTRACT

This paper describes selected aspects of the research work carried out within the research and development project called “An integrated system for supporting the access to information". The objective of the study were the possibilities of using the web application "Mobilne miasto" in an urban space. Particular attention was paid to increasing the efficiency of access to information about the urban space, as well as to allowing impact on the environment through the application. The article discusses the issues related to a study of information needs, where key features which states have been optimized were analyzed, that is: usefulness of information (obtained by studying the needs), the reliability of information used in urban areas (accuracy, comprehensiveness) and the time of access to that information (analysis of the amount of necessary information).

Keywords: Mobile devices, Usefulness of information, Reliability of information, Crowdsourcing

INTRODUCTION

A range of user’s interference reaches nowadays not only to the nearest place of work and residence, but every environment in which he resides. The increasing mobility of workers, the development of information and communication technologies have changed the structure of employment in macroeconomic terms. Dynamically changing challenges should be accompanied by technological solutions that will provide necessary information tailored to the users, their perception, knowledge, skills, and the situation in which they will be used (Pacholski, 2012).

The use of mobile devices is becoming more and more common, and also increasingly indispensable in the professional or personal life. Smartphones or tablets with Internet access are already being used in the EU by about 60% of the population aged 16 to 24 years (Seybert, 2012). Such a widespread use of mobile devices contributes to the increase of competition in both the improvement of mobile devices themselves and the ways of processing information.

The result of the research and design activities on the application was also the patent application for an invention that was associated with the influencing the formation of the immediate environment. The web application features

were used not only to capture information, but also to generate on convey information. Making information, which is often the professional knowledge, publicly available is used in the crowdsourcing - implementing such functionality was also foreseen for the application "Mobilne miasto".

Information about the immediate environment, as well as the ability to influence its formation, enhances safety, efficiency of performed activities and as a result also the quality of life. Facilitating the use of equipment and solutions that provide information about objects, events and opportunities of functioning in the area, provides a practical tool for shaping the environment. The possibility of shaping the environment, especially in urban space is an important issue not only for economic reasons (access to needed products, commercial buildings), but also to sensitize society and allow the social participation of people residing in a given environment. The use of the “Mobilne miasto” application allows for the implementation of such activities.

SELECTED ASPECTS OF RESEARCH WORKS REALIZED WITHIN "AN INTEGRATED SYSTEM FOR SUPPORTING THE ACCESS TO INFORMATION "

Preliminary research based on secondary sources

The major goal of the project “Integrated system for supporting the access to information in public space” (Mobilne Miasto) was to satisfy the information needs of user of mobile devices moving around the urban area. The scope of the project included the definition of range, format and manner of presentation of required information. Research in this area were conducted over several years. This article is based on the monograph “Integrated support system for access to information in urban space with use of GPS and GIS systems” (Goliński, Szafrański, 2012) and uses the results of research, which was conducted for the needs of this projects (Report from the quantitative…, 2011, Report from the qualitative…, 2011).

The first studies conducted for the purpose of the Mobile City project took place before the project application was filed. They concentrated on the use of in-formation by a user of information in urban space. Apart from that, the features of an IT system were analyzed, taking into account the issues of the user-IT sys-tem interaction as an ergonomic feature of the system. Also, it was tested what factors influence the quality of life in urban space. In 2009, the results of these studies were included in the following publication: “Chosen systems of access to information and their influence on formation of the quality of life in municipal space”. (Goliński et al., 2009). Also before the application was filed, selected information technologies supporting access to information in urban space were analyzed, with focus on the kinds of information needs, the functionality of the available solutions and the criteria for the evaluation of these solutions. These works were used in the publication entitled “A comparison of selected information technologies supporting the access to information in urban area.” (Graczyk et al., 2009) and “Analysis of the possibility to use information about urban space in mobile devices” (Goliński et al., 2012).

The most important research areas concentrated around the following issues:

- improving the quality of information about objects in urban space available with the use of mobile devices,
- Focusing on the user by shaping the human-system interaction
- Combining the hardware and software are and creating the logical and functional connection of human-computer tasks (Prussak, 2012)
- improving the functionality of the use of information related to locating objects in urban space,
- distinguishing a set of useful pieces of information related to location and concerning the improvement in the quality of life in cities,

The aforementioned issues were the subjects of a thorough and regular analysis conducted by the project team. In designing the application, the needs of users were taken into account, yet without disregard to the principles used in designing of new products (Golinski 2012). Research requiring specialist research tools and technical facilities was - for the sake of efficiency - commissioned to external entities.

User-oriented design is important when creating new systems providing information in mobile conditions, which must be useful and accepted by the users. Popularity of mobile applications, the scale of their use also entails the need to evaluate their ergonomics, which is expressed by taking into account the human anthropometric, physiological, biomechanical and psychological capabilities (Drzewiecka, Tiggy, Pacholski, 2012)

Qualitative research into information needs

The fundamental aim of the qualitative research was to identify categories of information related to urban space for which there is demand among the inhabit-ants of Poznań and visitors to the city The general research population included the inhabitants of Poznań and incomers or commuters – divided according to age, gender, professional status, knowledge of technical solutions and attitude toward innovation.

The basic scope of the research concerned a detailed specification of the range of information required by users, preferred by the respondents, the preferred ways of using a mobile device in order to obtain information, the preferred user's interface in mobile devices, and learning about the respondents' needs concerning the quality of information and the quality of the user's interface.

Basing on the words of the respondents, information which may be sought for by the users of mobile applications and which concerns the life of the city and urban space may be divided into the following groups:

- transport and location - information related to getting around in the city, timetables of means of public transport, information on traffic jams, road works and other traffic difficulties, as well as about ways to reach a given destination,
- leisure activities - cultural and entertainment activities (cinemas and theaters, concerts, exhibitions, festivals), sports (sporting events such as games and competitions), tourism (information about historic places, places to visit, hotels), weather (weather forecast),
- services and administration - administrative matters, the applicable law, opening hours and contact details of offices, institutions and services (shops, hairdressers, etc.), information on restaurants, pubs, cafes,
- local - planned investments (housing investments/ investments related to infrastructure, space development projects), advertisements (job market, private lessons, exchange of handbooks),
- hobby - information related directly to free time, including information about the history of Poznań or information related to sports and Poznań sports clubs.

Grouping of the topics of requested information is also related to how often they are sought. Information needs and frequency of searching for certain information was juxtaposed basing on the opinions of the respondents - this is presented in Fig.1.

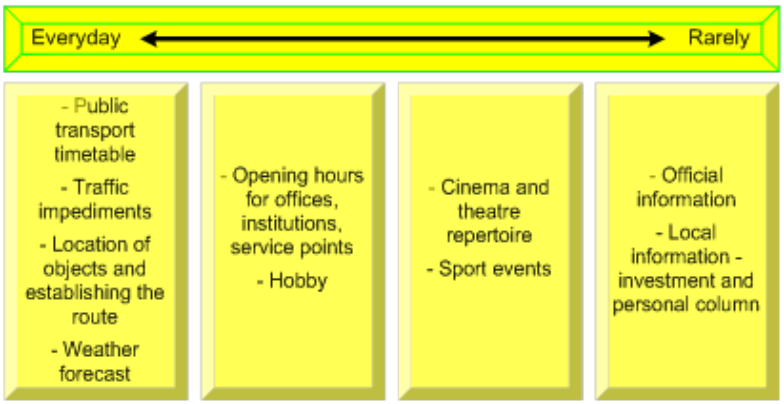

Fig.1. Types of information needs and frequency of searching for information. (Adapted from: The qualitative research …, 2011).

Knowledge on the respondents' information needs and their validity - as specified by the respondents themselves - was very precious for the project team and made it possible to plan the structure of the database and potential sources from which to feed it. Another useful piece of information included differences in information needs depending on the time of the week. The respondents indicated that on working days the most sought information was information related to transport and travel within the city, as well as information related to services and the opening hours of particular shops, pharmacies, etc. In the case of students, the information sought at that time included also culture and entertainment, as students look for opportunities such as cheaper cinema tickets and lower pub prices on weekdays (as opposed to weekends). The information searched for at weekends is mostly needed to plan free time activities, so cultural and entertainment information, as well as weather forecast are among the most desirable. Another useful piece of information for the team designing the application was different information needs in a week. This may translate into organizational requirements related to the schedule of feeding the database but also - allows to plan the server access load.

Another conclusion from the research was that the designed application is an example of an innovative use of a web application. At present, more popular applications are native ones, dedicated to a given platform, whereas the solutions based on mobile sites, despite their smaller share in the market, indicate the direction into which mobile solutions will develop. One visible disadvantage, with slow internet connection, is a slower data trans-mission rate. Therefore, a significant part of the qualitative research was devoted learning about the plans of the respondents concerning the use of the internet and the telephone in the nearest future.

The respondents declared that at present they use the mobile internet mainly in situations referred to as "emergencies" - when they need to connect the inter-net fast and have no possibility to use a stationary connection. Such situations take place mainly when they want to locate a place, find out about route directions or check emails, which is important mainly for people whose work requires them to stay in constant touch with their customers and check emails frequently. The group of people using the internet intensively is constantly growing. "In the first half of 2011, as many as 66% of households had a computer and 61% of them also the internet access. Over 50% of all households have constant internet connection, 15% uses mobile access offered by mobile operators. In the first half of 2013 computers were present in 70% of households and Internet access in 66,9%, 18% uses mobile access and mobile phones are used by 87,4% (Batorski, 2013). Those people use the Internet in mobile devices in their spare time, communicating with friends, checking emails or simply surfing the internet. There is a group of people who prefer the mobile internet to the "stationary" internet precisely due to its mobility, which makes it possible for them to access it in any situation and at any time. Such people are a potential group of the so-called "heavy users" (regular customers) of the Mobile City application.

The reason for which some people who use the mobile internet only occasion-ally is the inconvenience of data viewing, related to problems with connection speed and the insufficient technological parameters of devices. Another significant barrier is also the conviction that the price of such connection is very high.

One of the tasks of the project is to integrate data already available on the internet. The conducted research confirmed that there is a need for a guide with comprehensive information concerning the life of the city. Among the main factors characterizing the ideal system, the respondents mentioned a clear form of presented information, brief and concrete content, a good data loading speed (thanks to modest graphics) and the topicality of the presented content.

The scope of the qualitative research involved also the shape of the interface of the application in question. The respondents mentioned that it was important that desired information was presented both in the form of an internet website and an application. A guide in the form of a website was a solution presented relatively more often and preferred by the respondents due to its obvious, natural and more familiar image. The respondents mentioned the examples of already existing integrators / information portals such as www.epoznan.pl, or www.mmpoznan.pl. People often using the mobile internet on mobile phones were more enthusiastic about the creation of mobile applications which would offer quicker access to information.

The mobile application the respondents would appreciate should be free of the existing problems of similar applications, including:

- no up-to-date contact details of companies and institutions,
- the accumulation of obsolete and outdated information concerning past events,
- the lack of one place - a portal / website with all the necessary information about the city,
- no information concerning the practical aspects of getting around the city, such as parking bikes.

The respondents, apart from indicating problems with the existing information and forms of its distribution, described also their own preferences concerning the form of urban information obtained via mobile devices. Their comments concerned both the form and the functionality of solutions, and among the most frequent suggestions were: a) as far as information features are concerned: concrete, brief, up-to-date, b) as far as graphics is concerned: avoiding "heavy" elements, more text than graphics, headlines and key words in bold, maps and logos for location, discrete colors [black and white], a large, clear font, c) as far as the functionality is concerned: no or only a limited number of advertisements, relevant hits, the size of the page should automatically adjust itself to the screen size.

In the course of the research, the respondents were divided into two groups: occasional and regular users of the mobile internet. Selected situations and arguments for the frequency of using mobile applications are presented below for the two groups: (A) occasional users and (B) regular users of mobile applications.

A) The respondents who declared that they use mobile internet only occasional were usually very pragmatic with this respect. They only used the mobile internet in emergencies, when it was impossible to use stationary

connection. They focused on: obtaining directions / navigation, reading emails or checking the inbox, or doing a bank transfer. Their reasons for limited use of the mobile internet were as follows: the inconvenience of mobile devices [a small screen, limited battery strength], problems with the speed of the connection and its low quality [frequent disconnecting], insufficient level of technical parameters of mobile devices preventing the proper display of some websites, faulty operation of selected applications; the respondents were often convinced of the high cost of the mobile internet connection, fear poor antiviral protection when connecting from mobile devices and - quite frequently - declared that they were not used to using the mobile internet.

B) People who used the mobile internet more frequently described a wider range of occasions when it could be useful. Apart from purely practical motivations they mentioned entertainment (social networking sites, YouTube and similar sites, visiting sites in relation to hobbies). Entrepreneurs reported their need for continuous internet access. Among students there were people who declared using the mobile internet while being at the university - during classes or exams. The main reasons for the frequent use of the internet on mobile devices included: the possibility of using free internet thanks to the Wi-Fi technology, the conviction that the costs of mobile internet connection were low [in this context, respondents pointed out at Internet service packages, talked about their desire to relieve boredom or about laziness (manifested in reluctance to switch on a stationary computer to check emails), the conviction that some information may be faster found on the mobile phone than on a computer, as starting the latter takes a certain amount of time].

A number of ideas can be drawn from the analysis of the results of the qualitative research. Many of them were already designed in the solution and their useful-ness was now confirmed by the respondents. Among them are:

a) the system of categories and subcategories - the respondents claimed that the city guide website must be as readable, clear and user-friendly as possible. Moving within a category would be possible through links - having clicked on a given category the user would be redirected to the list of subcategories and then - the “deeper” content of a given subcategory,
b) data selection and personalization – an idea emerged to increase the functionality of the solution through customization and storing of the previous searches, which would result in a quick access to concrete, preferred information corresponding to the needs of the user. Users would choose fields and subcategories of their interest and then they would receive information filtered in accord-ance with their assumptions. The system could store the settings of a given user and every time he logs in - redirect him to the parts and categories he has read the most so far.
c) application with speech generator - an ideal system should be based on the al-ready existing guides and use source data from services such as gazeta.pl, epoznań, of the websites of offices and institutions. A given piece of information would be searched for by the criteria entered. The user would not have to go through different categories but would be immediately given the information he or she is looking for. The innovativeness of the system would involve the system of location services using a speech generator. At the user’s command, the system would search for places corresponding to a given voice command and located in the vicinity of the user. In the advanced version of the system, it would also show the directions in Poznań taking into account the location of objects which would be of interest for a given user.
d) the respondents also pointed out the following necessities: a clear interface, minimum graphics, calm colors

In the conclusion, the respondents listed their expectations towards a potential phone - the most important desired features:

- a durable battery - about 7 days without charging for talks and 2-4 days for the internet,
- a good processor/ operational system to ensure efficient work of the phone,
- a camera capable of taking good quality pictures,
- a good display screen - of sufficient size and appropriate resolution,
- a touchpad and an in-built keyboard / touchpad,
- a good speech synthesizer - so that you do not have to touch the keyboard if it is not necessary,
- a durable case/ a thin case - so that the phone does not get damaged easily when it falls,
- Wi-Fi, Bluetooth, calendar, voice recorder, alarm clock, waterproof, slots for two cards.

The comments which the respondents made during the qualitative research became the basic material for developing a set of issues to be included in the quantitative research.

Both qualitative and quantitative research constituted an important support in the development of functional solutions and creating the database structure for web application "Mobilne Miasto".

Quantitative research into information needs

The objective of quantitative research, which involved a group of 400 respondents, was to gather information on the type, frequency, and places in which the respondents search for information related to urban space, the use of Internet in searching for information related to urban space, use of the Internet on mobile devices, the preferences of respondents to the features of the sought information. The profile of the GPS user was determined. The key questions in the survey were: type of information searched for, the intensity of the information sought and determining the desired features of information.

The participants of the research usually sought information concerning: transport [timetables of means of transport, routs to given destinations], events taking place in Poznań and directions. Needs related to this kinds of information were declared by 68%, 62% and 48% respondents respectively (Fig. 3.4). Another group of information concerned urban topography, including the location of retail and service outlet [also catering points], offices and institutions in the city, centers providing emergency assistance, restaurants, pubs, cafes, promotions and prices, traffic jams in the city, road works and other transport difficulties in the city, as well as the location of historic and simply interesting places in Poznań. Occasionally, respondents declared information needs related to the location of car parking spaces, objects in the vicinity of the place where the information seeker was at a given moment, accommodation addresses, hotels and bicycle paths.

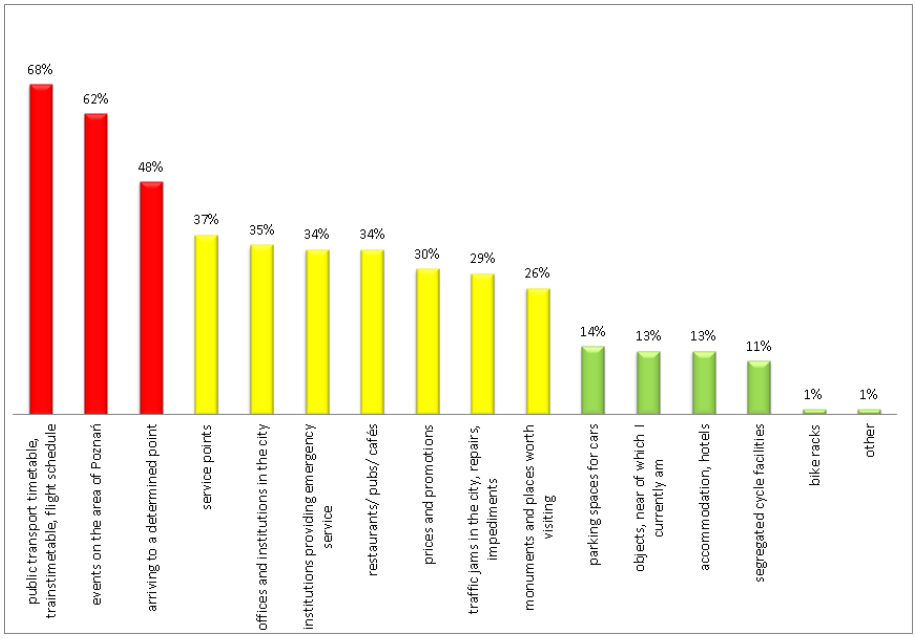

Fig. 2. Topics of desired information. (Adapted from: The quantitative research ..., 2011).

An important information for application design was that the respondents sought information in the internet with different frequency - half of them did that at least once a week, and the rest - less than once a week. The most often sought subjects include timetables (public transport in the city/ trains/ planes) - 25% of the respondents needed this kind of information at least twice a week. Another useful kind of information was information about traffic jams, road works and other traffic obstacles - 33% of the respondents sought this kind of information at least once a week - fig. 3.

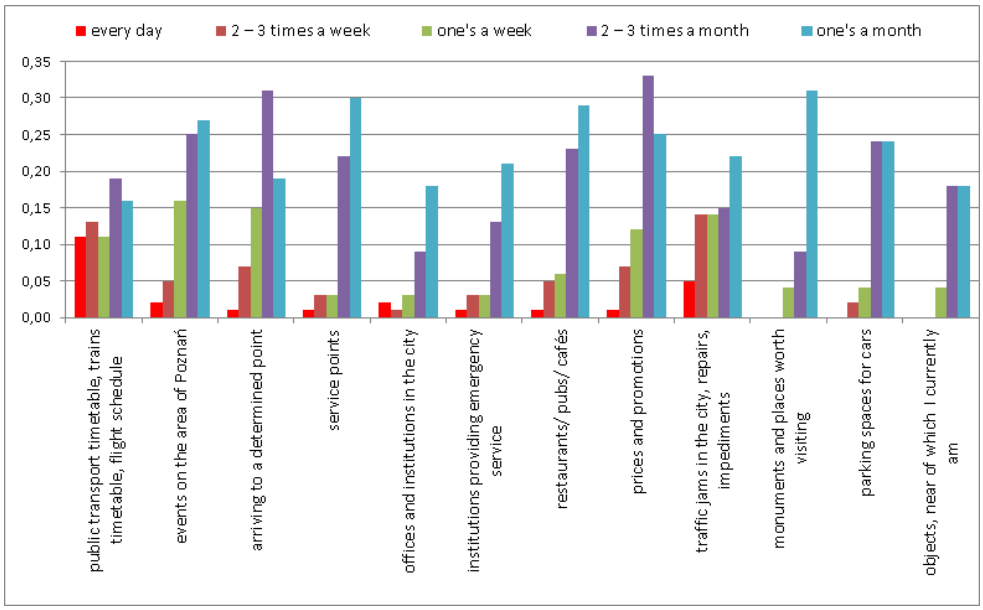

Fig. 3. Frequency of desired information. (Adapted from: The quantitative research ..., 2011).

From the respondents' answers, the researchers could conclude that it was not difficult to find the desired information but the correctness of the description of a desired destination might vary significantly. The estimation of the time needed to reach a destination appeared to be the key element of the desired information. The remaining aspects are a bit less important [the route, distance, opening hours] – Fig 4.

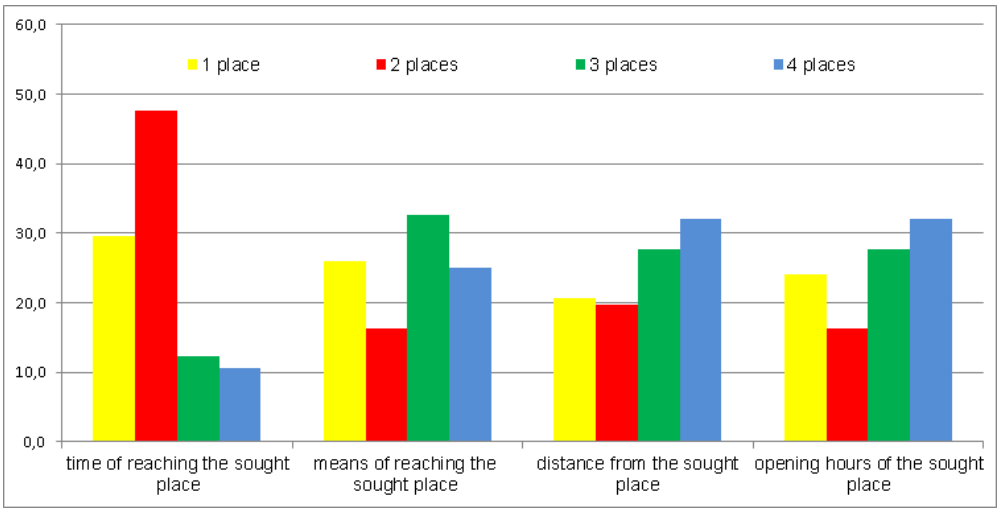

Fig. 4. The importance of information on how to reach (on foot or by car) a given point, in the respondents' categories (Adapted from: The quantitative research ..., 2011).

The key finding from opinions of the respondents regarding the characteristics of information, whether they were students, businessmen or other respondents, was the need to ensure in the mobile application the validity, completeness, and availability of data - Fig 5

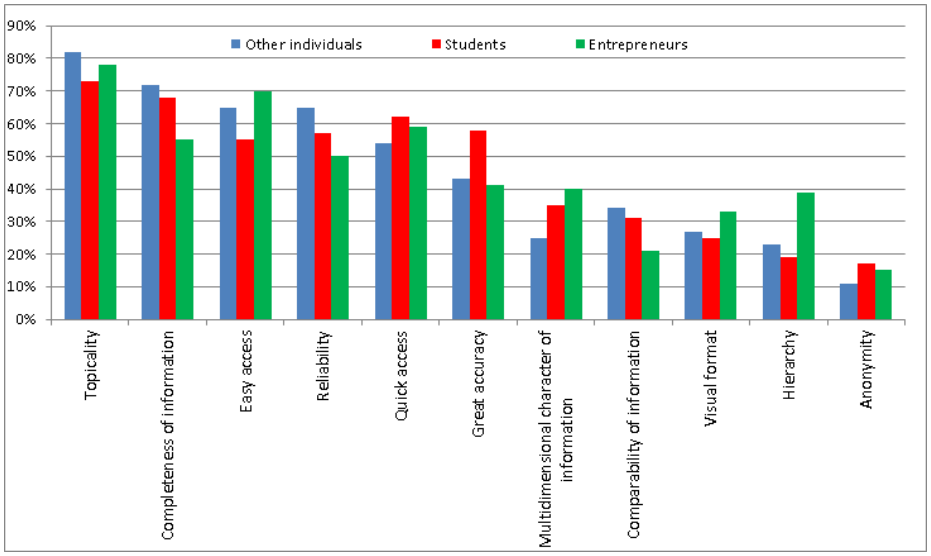

Fig. 5. Preferred information profile, in the respondents categories. (Adapted from: The quantitative research ..., 2011).

Among the main conclusions summarizing the results of studies that have taken into account the full range of user needs including technical, economic, organizational, environmental, ergonomic, and social criteria, the most important aspects should be stressed:

- the respondents usually sought information concerning transport e.g.: timetables of means of transport, routes to given destinations, and concerning events taking place in Poznań. Apart from that, the desired in-formation included also the topography of the city, retail and service outlets, e.g. food outlets.
- the estimation of the time needed to reach a destination appears to be the key element of this kind of information. The remaining aspects, such as the route, distance, opening hours, are a bit less important.- The internet is the key source of information. Notice boards and friends are much less frequently used as sources of information.
- The respondents sought information in the internet with different frequency - half of them did that at least once a week, and the rest - less than once a week. The analysis of the results indicates that it is not difficult to find desired information
- the most popular device used to seek information on the internet is still a computer. With this respect, mobile devices are used definitely less of-ten - every third student and fewer than every fifth individual user or entrepreneur. Among mobile devices used to seek information on the internet the respondents usually mentioned mobile phones.
- the users of mobile devices use them to seek information on the internet every day or almost every day. This is, basically, the same information as in the case of searching via other devices - information about how to get to a selected destination or about events in the city,
- the key element of information is its up-to-datedness. Due to the nature of the information sought and the fact that it is necessary in a given moment - 2 groups of attributes appear equally important: the speed and ease of access, and reliability and completeness of the information acquired,

The results of the qualitative and quantitative research confirmed to a large extent the assumptions concerning the expectations of users of mobile devices.

Information needs about the immediate environment, as well as the ability to influence its shape increases the safety, effectiveness of working and studying, gives greater satisfaction from leisure, and as a result also improves the quality of life. Facilitating the use of equipment and solutions that provide information about objects, events and opportunities for functioning in urban space, is a practical tool for increasing the comfort of functioning in the modern world. The use of mobile devices also allows the people in agglomerations to increase their conscious participation in the shaping of their environment and influencing their social life. An example of such situation is the described below proposal to use the web application "Mobilne Miasto" in shaping and analyzing the market.

HOW TO VERIFY THE RESULTS OF SPATIAL METHODS OF MARKET ANALYSIS

Today, more and more technical solutions require close association with economic and social components. An example of such approach was the use of web application "Mobilne Miasto" to verify the results of the use of spatial methods of market analysis. Publicly available information and knowledge derived from smartphone users is an example of the use of information in crowdsourcing. The use of web application " Mobilne Miasto " is thus both an example of a solution using ergonomic assumptions and taking into account the socio-economic determinants associated with ergonomics (Pacholski, Jasiak, 2012).

There are many methods of market spatial analysis and spatial statistics, related to the topological, geometrical or geographical descriptions of objects. They vary in the degree of complexity, use various modern technologies, such as telecommunications technology, statistical software, computer technology, the Global Positioning System and Geographic Information System, enabling the management of geographic data, creating own data, using of GPS data, performing spatial analysis or creating maps. There are well known methods based on interpolation, regression or autocorrelation (based on the study of spatial relationships and using the idea called "Tobler's first law of geography", which can be shortly described as " Everything is related to everything else, but near things are more related than distant things ").

The application of spatial analysis models is very broad and applies to a variety of areas: demographic analysis, organization of marketing activities, tourism planning, forecasting and correcting activities of a social nature. Using the results obtained based on spatial models should complement the demographic, economic and social modeling strategy.

In the solution using the web application "Mobilne Miasto", the use of a computer program was assumed, which makes it possible to create subsystems of spatial analysis, subsystem of geographic information, database of infrastructure elements connected with a specific location, database ("data mining") serving as a "repository of ideas" how to develop or improve existing infrastructure or how to plan new infrastructure elements and a system of data mining that reveals knowledge, draws ideas, suggestions from available databases.

A tool for predicting the location of infrastructure elements contains such elements as: the first storage tool (eg smartphone) for storing location information concerning the changes in the infrastructure in the area, the second storage tool (eg, a server) for storing specific data associated with characteristics of changes in the infrastructure and a processor coupled with both the first and second storage tool, that identifies the elements of the infrastructure which require repairs, changes, and processes location information from both storage tools. .

Web application "Mobilne Miasto " allows for the development of a method that will efficiently and effectively support decision-making processes related to the positioning of objects of commercial and public use purpose in the particular agglomeration. Verification of the results of the use of spatial methods of market analysis according to the developed method is implemented in several steps. The base server collects the spatial analysis models developed in the form of mathematical algorithms and creates a database of models. Database of spatial analysis models is subject to continuous development. The base server also hosts the dedicated software and contact databases containing the addresses of the objects to be evaluated . The user of a mobile phone device with Internet access, equipped with a GPS transmitter and dedicated server software, sends information describing the objects to the base server. Database of spatial models, database of objects, dedicated software and database of description standards are connected by relationships which, thanks to the functionality of a dedicated software, are used to verify the results of the application of spatial methods of market analysis. Transfer of information between the mobile phone and the base server through a dedicated software is bilateral, which provides feedback and gives other system users access to a verification.

The use of the web application "Mobilne Miasto", as a way to verify the results of the application of spatial methods of market analysis fulfils the assumptions of the crowdsourcing method. Use of the application is a convenient solution, allowing to reduce the size of the study population during the implementation of spatial analyses. By examining the dependencies in one location/object we can be predict values or expectations for another location/object without performing simultaneous observations in both places. The above-described usage of the application is just one example of the possibilities of using web application "Mobilne Miasto", which was developed in the project "An integrated system for supporting the access to information", done as a part of the 10th contest of development projects funded by the National Research and Development Centre.

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CONCLUSIONS

Designed application and its implementation were an R&D undertaking, of a unique, highly dynamic nature, yet very sensitive to environment factors. An important conclusion from the study is that while designing a technological solution we must take into account the technical, economic, organizational, environmental, ergonomic , and social criteria (Pacholski, Jasiak, 2012). In the course of realization and development of each project such issues as changes in customer requirements (due to the growing needs and greater awareness), legal conditions, the emergence of new knowledge and updating of economic assumptions, should be considered on an ongoing basis.. The basic goal of the project, which was to create a pilot version of the system of providing urban space users with a comprehensive and up to date spatial information along with the ability to supplement the descriptive attributes have been realized. An interdisciplinary look at the transfer of information confirmed, already at the research stage, the need to connect the human-centric approach, focused on the care for human needs, with the engineering way of practical problem solving. A manifestation of this approach was including research and testing in the design of a set of attributes and criteria sought by mobile device users. Working on the design of the application confirmed that improving the quality of life is largely based on the potential use of information and communication technologies in improving communication and decision-making processes, but indispensably requires a comprehensive-holistic approach to analyzed projects.

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