

The development of accessible urban environment using the project “mobile application “City without limits”” for an example

Anastasiya Maslennikova^{1,*}, Dmitrii Maslennikov¹, Evgeniya Chikova², and Svetlana Pankova²

¹Ekaterinburg branch of Russian Presidential Academy of National Economy and Public Administration, 8 march Str., 66, 620144 Ekaterinburg, Russia

²Ural Federal University, Mira Str., 19, 620002 Ekaterinburg, Russia

Abstract. This article addresses the issues of accessibility of the urban environment for people from groups with limited mobility. In addition, a mobile application called “City without limits” is introduced, which provides conditions for the comfortable movement of citizens with disabilities in urban space. The concept of this mobile application, its functionality, its technical characteristics are described. Pilot survey clarifies the target audience of the application. The strategy of further development and support of the project "City without limits" is outlined.

1 Introduction

The development of social infrastructure today is an indispensable component of the socio-economic development of any region of the Russian Federation and an indicator of the quality of life of its population. In this regard, one of the main components of the improvement of the social infrastructure is a creation of an additional environment - a physical environment, transport facilities, information and communication facilities, equipped to remove obstacles and barriers created by an individual or group of people, taking into account their special needs [1]. In particular, it is necessary for low-mobility groups of the population - people who have difficulties in moving themselves, obtaining the service, the necessary information or in orienting in space. Low-mobility groups comprise disabled people, people with the health limits (temporarily or constantly), people with baby carriages and. Etc. [2]

Currently, in Russia, the share of people with limited mobility is up to 41 % (58 million people) of the total population of the country, including: 10.7 % - disabled people of all ages; 16.3 % - elderly people (older than able-bodied) who are not recognized as disabled; 6.2 % - people with temporary disability, with Luggage, other groups of the population with mobility restrictions; 7.7 % - children under the age of 4 years (about 8 million people, including accompanied by one adult of working age – about 3 million people) [3].

The creation of comfortable conditions for low-mobility groups of the population is implemented through the state program "Affordable Environment" approved in 2011 and

* Corresponding author: maslennikova-ay@ranepa.ru

extended until 2025. This program is supplemented by a number of relevant building SNIps which apply to the term "universal design" and understood as the design of objects that can be fully used by all people without the need for special adaptation. It is within the framework of SNIps appears the definition "a building or structure with an accessible environment for low-mobility groups" (more often referred to as an apartment building), which is interpreted as "a building in which a complex of architectural and planning, engineering and technical, ergonomic, structural and organizational measures meeting the regulatory requirements of ensuring the accessibility and safety of low-mobility groups of the population is implemented." Thus, the accessible environment is formed at different levels - within the macro (in places of urban public infrastructure) and microspace (territory of apartment building and adjacent areas) [4]. In addition, the right of representatives of people with limited mobility to an accessible environment is also enshrined in a number of legislative documents, such as Federal Law No. 181-FZ "On social protection of disabled people in Russia" [5] and Federal Law No. 419-FZ "On amendments to certain legislative acts of the Russian Federation on social protection of persons with disabilities in connection with the ratification of the Convention on the rights of persons with disabilities" [6].

Works to ensure an accessible environment at external improvement facilities for people with different degrees of mobility are carried out annually in Ekaterinburg, which is reported by the Committee for Improvement of the Ekaterinburg City Administration. Nevertheless, changing the city architects in accordance with the principles of barrier-free and universal design is a long-term labour-intensive and expensive process, therefore alternative temporary solutions should be used for global urban planning changes and the widespread re-equipping of problematic objects. One of such a solution can be the mobile application "City without limits".

2 Materials and methods

"City without limits" is an application for various digital devices, including Android and IOS smartphones. The product format is a map of the city with all features of the landscape, accompanied by information on the presence/absence of a category of equipment for creating an accessible environment inside and outside public buildings [7].

In the beta version, when registering in an application, the user sets the parameters regarding his health restrictions (for example, visual impairment, musculoskeletal disorders) without having to re-input.

In addition, the user has the opportunity to select a specific organization (shop, pharmacy, cafe, etc.), to check the permeability of the facility, equipment of it within a barrier-free environment principle, and to assess the possibility of visiting it without leaving the house (including due to additional, permanently updated background information: description, photo-, audio).

The user will be able to lay the route from the point «A» to the point «B», which will be automatically constructed on the principle of maximum levelling of barriers of the urban environment, for example, high kerbs and stairs.

For the convenience of the application, the search of objects is arranged according to the principle of the category: medicine, education, products, etc., the function of tracking the user's location is included.

Interesting is a data collection mechanism to update information on the features of the urban landscape and the level of adaptation of a public infrastructure facility to the requirements of barrier-free and universal design.

By this mechanism, information is provided to developers through multiple channels. The first channel is organized by lobbying the application through the mass media, which brings to the attention of representatives of a number of institutions and companies already

equipped for low-mobility groups of the population: they have the opportunity to provide relevant information about themselves so they will increase the attendance of its object and gain reputational benefit. On the second channel, information is received from previously instructed volunteers who volunteer to explore the city of Yekaterinburg in their spare time. The emergence of the third channel is due to the partnership between the team of social entrepreneurs "Atmosphere" supervising the project "City without limits" and 2Gis, which provided material of the «layer» of Urban facilities that the company had access to. The fourth channel relates to the provision of data on urban infrastructure facilities and routes by the users themselves: this channel will become operational as soon as the application will be on the market. Finally, it is possible to have a fifth channel: it is planned to collect information of the objects and routes of the city of Yekaterinburg through the service of paid assignments «Yandex.Tolok».

From a technical point of view, "City without limits" is a mobile application and server part used to build routes. React Native was used as the framework for developing the mobile application. This framework allows to use the JavaScript language to create a cross-platform code base for Android and iOS platforms. At the moment, the application fully implemented the scenario of selecting the category of disability, points of departure and destination with geocoding, construction of a route by map. Google Maps is still used to display maps, but the transition to OpenStreetMaps is planned. For route construction is used the OSRM engine, which operates on modified mapping data, including the data on obstacles in the city that we have collected.

So far there are no products in Russia similar to the "City without limits", although attempts to create similar applications were made earlier (website «Accessible Environment», accessibility map from the Teva company). The failure of these products was due to three significant weaknesses: lack of a user-friendly interface, lack of information on urban infrastructure and lack of a mobile version of the product. But there are already a number of assisting services for people with reduced mobility (mainly for people using wheelchairs): an open cartographic database of OneStreetMap [8], road network analysis systems for finding obstacles [9,10,11], navigation systems using computer vision to find obstacles [12] e.t.c.

Initially, as a niche segment, the application team identified a mobile application segment for people with disabilities (the blind, the deaf and people with musculoskeletal disorders). In calculating the market capacity, it has been determined that the number of potential consumers is equal to the total number of persons with disabilities aged 18 and over living in the city of Yekaterinburg, i.e. 88,000 persons. without the MAU coefficients (the number of unique users who run the application at least once a month) and MAU/DAU (the proportion of all players who use the application every day), which would reduce the number of real users by 60-70%. However, a pilot marketing study had shown that there were other groups of potential users.

3 Results and discussion

In order to determine the marketing strategy for the promotion of the mobile application "City without limits," a two-day pilot survey was conducted in December 2019, which resulted in 102 questionnaires of residents of Yekaterinburg and some other cities with millions of residents. According to the data obtained, it is possible to draw a generalized portrait of a potential user of the application: women between the ages of 26 and 35, who can be divided into three groups (Fig.1,2). The first and largest of them is represented by those who have young children and constantly use a baby wheelchair to travel around the city. The second group includes those who care about urban improvement issues. The third

group includes those who themselves have any health restrictions or whose family member is a person with disabilities (Fig.3).

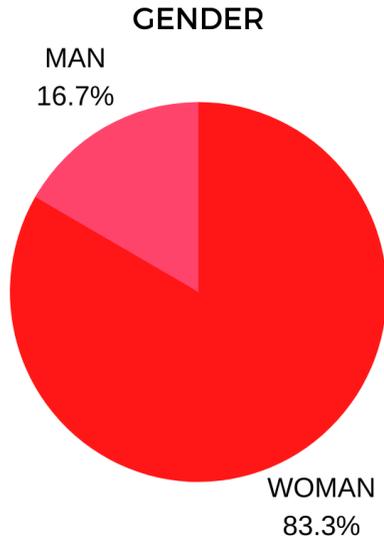


Fig. 1. Gender of pilot survey respondents

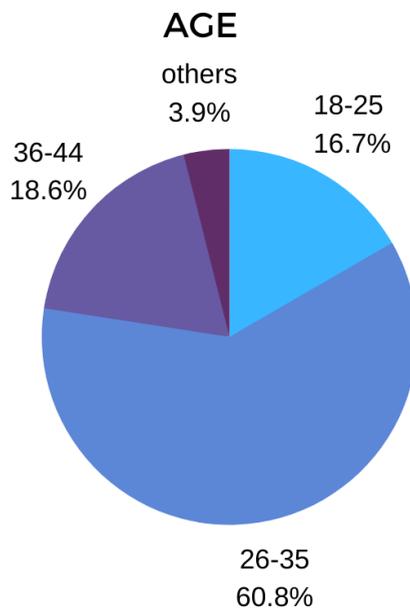


Fig. 2. Age of respondents to the pilot survey

Respondents have noted the following obstacles in the urban environment in order from the most critical to the least critical, which cause them the greatest discomfort if we talk about comfortable movement

1. lack of comfortable entrance groups in shops / cafes / government offices (uncomfortable ramps, heavy doors, lack of an automatic door opening system and help-call buttons, etc.);
2. lack of ramps / uncomfortable ramps (with a steep angle of inclination / absence of handrails, anti-slip elements, etc.);
3. the absence of the equipped elements of an accessible environment in most mains of public transport (absence / small amount of "low-floor" transport);
4. the abundance of stairs in the absence of any devices to overcome them.

In addition, about a third (32%) of the respondents have already adapted to the existing barriers of the urban landscape or have no problems with movement with these barriers. However, 77% of respondents have said that they like the idea of such an app, and they would like to use it and are willing to pay for it. In the latter case, 44% of respondents preferred the option with an annual subscription of 300 rubles, 20% have chosen the option with a monthly subscription of 40 rubles, 8% are ready to purchase a six-month subscription for 180 rubles, and another 8% of respondents have chosen a three-month subscription for 100 rubles.

Main categories of respondents

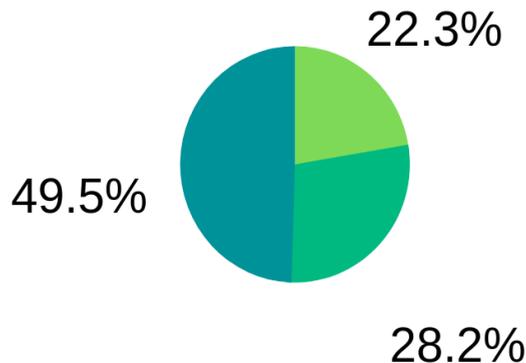


Fig. 3. The main categories of respondents to the pilot survey: 49,5% - parents who constantly use a stroller to travel with a child around the city, 28,2% - people not belonging to low-mobility groups concerned with the improvement of their locality. 22,3% - people with disabilities and members of their families.

Moreover, the potential users of the application are highly interested most in the following functionality (in descending order)

1. building a safe and comfortable route with an avoidance of user-defined obstacles;
2. an indication of the facilities of social infrastructure that are accessible for citizens with disabilities, indicating which accessibility elements are present in the building;
3. updating the information about the construction zones in the city;
4. a warning system about the time of arrival at a particular stop of the equipped (low-floor) public transport.

In the beta version of the application only the option of route construction with extension of the given obstacles is implemented, however the potential of inclusion of other required functions is present and technically they can be incorporated into the current version.

4 Conclusions

The current main task, realized in the application, is the construction of a safe and comfortable route with the encirclement of the obstacles laid down by the user. With the help of the information centre opened at one of the stages of the "City without limits" project, the corrosive collection of data on the objects of the city of Yekaterinburg has already been surveyed more than 150 of them and the information base of the application is being developed. Work is under way to further expand the functionality of the application.

It is worth mentioning that the launch of the application project was due to its participation in the "Startup_reality. Your key to business", which was organized by Russian industrialist and philanthropist Igor Altushkin, the owner of a Russian copper company, and his wife Tatyana Altushkina: the team of the application was able to get more than a million rubles for realization of "City without limits». On the other hand, participation in the All-russian Social Initiatives Accelerator "RAISE" helped to refine the components of the business plan and get access to potential partners of the team. Further financing of product development and support is planned from several sources. First of all from the funds received from the realization of the product (at present potential users have indicated that they are ready to buy an annual subscription for 300 rubles or a monthly subscription of 40 rubles). In addition, an application has been submitted to the Fund for Innovation Promotion ("Bortnik Foundation") for the "Start" programme to support startups at an early stage of development. In addition, "City without limits" has already entered the short-list of projects of the competition "Innocent Society" in the nomination "Youth Entrepreneurship", the prize fund of which is 500 thousand rubles. In other words, different ways will be sought to promote and scale up the project.

Another survey is under preparation, with a view to collecting information within a wider population (from 2,500 to 3,000 people). In addition, a focus group is planned for July 2020 among those who use the bicycle as a daily means of transportation, as they may also be considered potential buyers of "Cities without limits».

Acknowledgements

The article was prepared with the support of the Russian Science Foundation, on the topic of the project «Challenges of the Transformation of the Welfare State in Russia: Institutional Changes, Social Investment, Digitalisation of Social Services», No. 19–18–00246, which is being implemented at St. Petersburg State University.

We express our gratitude to the members of the team of the mobile application "City without limits" and the team of social entrepreneurs "Atmosphere" UIU RANEPa: Maslennikova D.Y., Maslennikova A.Y., Zhuravskaya V.V., Schepetkina M.E., Pushkareva D.R., Sabantsev O.K., Panova A.V., as well as programmers Markov V., Khromov D., Fadeev I., Gayyulin D., Efimov V. and Gareev B.

References

1. The state program of the Russian Federation "Affordable Environment" for 2011–2020: passport.Ministry of Labor and Social Protection: official. Site, <https://rosmintrud.ru/>
2. Accessibility of buildings and structures for people with limited mobility. SP 59.13330.2016. Updated version of SNiP 35-01-2001, Code: normative and legal basis, <http://docs.cntd.ru/>

3. V. Rimshin, V. Borkovskaya, E. Degaev, I. Shubin, *Barrier-free urban environment and risks of project solutions*, <https://www.e3s-conferences.org/>
4. Accessibility of the environment for people with disabilities and people with limited mobility: guide, <https://bit.ly/>
5. Federal Law No. 181-FZ "On social protection of disabled people in Russia", <http://www.consultant.ru/>
6. Federal Law No. 419-FZ "On amendments to certain legislative acts of the Russian Federation on social protection of persons with disabilities in connection with the ratification of the Convention on the rights of persons with disabilities", <http://www.consultant.ru>
7. "The city without limits", Vkontakte is a social network, <https://vk.com/>
8. OneStreetMap: official site, <https://www.openstreetmap.org>
9. T. N. Weyrer, H. H. Hochmair, G. Paulus, *Transportation Research Record*, **2469**, 108 (2014)
10. D. Ding, B. Parmanto, H. A. Karimi, D. Roongpiboonsopit, G. Pramana, T. Conahan, P. Kasemsuppakorn, *Annual International Conference of the IEEE Engineering in Medicine and Biology – Proceedings*, 4790 (2007)
11. P. Kasemsuppakorn, A. H. Karimi, *Journal of Location Based Services*, **3(1)**, 24 (2009)
12. M. Alshraideh, B. A. Mahafzah, S. Al-Sharaeh, Z. M. Hawamdeh, *JEAIL*, **27(4)**, 471 (2015)