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SMART MOBILTY SOLUTIONS: LESSONS FROM ZURICH

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Abstract *The focus of this paper is on smart mobility concept (SM) and its contribution for achieving higher quality of life. In last decade SM solutions become a very important instrument of urban planning, which are applied in response to various challenges that cities around the world are facing. Consistent to the aim of this paper, the examples from Zurich are analyzed, in which numerous SM solutions have been applied, making it suitable for examining the effects of their synergic implementation for the quality of life improvement.*

Key words: *smart mobility, quality of life, Zurich*

REŠENJA PAMETNE MOBILNOSTI: ISKUSTVA IZ CIRIHA

Apstrakt *Fokus ovog rada je na konceptu pametne mobilnosti (PM) i njegovom doprinosu u postizanju višeg nivoa kvaliteta života. U poslednjoj deceniji rešenja PM postala su veoma važan instrument urbanog planiranja, koja se primenjuje kao odgovor na brojne izazove sa kojima se gradovi širom sveta suočavaju. U skladu sa ciljem ovog rada, analizirani su primeri iz Ciriha u kojima su primenjena različita rešenje PM, što ga čini pogodnim za ispitivanje efekata njihove sinergijske primene na poboljšanje kvaliteta života.*

Ključne reči: *pametna mobilnost, kvalitet života, Milano, Cirih*

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1. INTRODUCTION

Intensive urban development poses serious threats to cities around the world and among others one of the most common is the increase in the number of private cars, i.e. the degree of motorization. Namely, due to the general trend of enormous increase of the degree of motorization multiple negative consequences occur: higher consumption of energy; increase of: pollution, health-related issues, traffic congestion and noise level; decrease of traffic safety, which all have significant unfavorable implications on the citizen's quality of life. In addition, the mentioned problems push enormous pressure towards city management and pose serious challenges for urban planners and city governance [1,2, 3]. The accelerated urban development is also accompanied by the prosperity of information and communication technology (ICT), which are proactively applied to address above problems that threaten the citizen's quality of life. They are applied through the guidelines of smart city development strategies, which transform traditional cities into smart cities. These strategies aim to leverage modern technologies like data collection, analysis, and communication to create a more sustainable, efficient, and livable urban environment for citizens, that is to improve the quality of life in urban spaces as well as the natural environment and to ensure high-quality city services governance [4]. Smart cities have many structural components and among all of them six are crucial: economy, people, living, environment, governance, and mobility.

The focus of this paper is on smart mobility concept (SM) and its contribution to decreasing of number of private cars, creating healthier cities, facilitating of conduction of various citizens' activities and achieving higher quality of life. The SM is widely promoted concept which includes various measures in the context of minimizing urban congestion, polluting emissions and road accidents and offers user-oriented transport solutions [5, 6]. Through the integration of advanced technologies and data-driven solutions, SM enables innovative and sustainable solutions in the aim of increasing of urban mobility, such as the development of public transport that respect environment, supported by advanced technology and proactive behavior of citizens. In this context, SM becomes a very important instrument of urban planning, which is applied in response to numerous challenges that cities and citizens are facing. Consistent to the aim of this paper, the examples from Zurich are analyzed, in which various SM solutions have been applied, making it suitable for examining the effects of their synergic implementation for the quality of life improvement.

2. SMART MOBILITY SOLUTIONS IN THE CITY OF ZURICH

Zurich is the largest city in Switzerland with about 400,000 inhabitants. It ranks among the world's largest financial centers with a high level of living standard. The key challenges that city is facing are: expected population growth of 25% in the next 20 years [7], ageing population, increased traffic intensity, increasing mobility needs and energy consumption, which imposes on city governance the need for sustainable energy supply, more efficient city management, towards keeping quality of life high in the future.

In order to introduce more efficient city management, the ,,Smart City Zurich 2018'' strategy was adopted, which relies on the ,,Strategies Zurich 2035'' [8]. Three key areas are recognized in the strategy: smart mobility, digitalization of the city and smart participation of citizens, and a plan for the introduction of various smart solutions in the mentioned areas is foreseen. Except in this strategy, SM concept is also included in „Stadtverkehr 2025 Zurich". It should be highlighted that well-functioning, city-friendly mobility is a central prerequisite for the quality of life in the city of Zurich in all mentioned strategies. According to "Strategies Zurich 2035", the city of Zurich is meeting the increasing need for mobility by expanding public transport, improving pedestrian and bicycle traffic and attractively designing public spaces.

Apart from this strategy, the ,,Smart Mobility strategy for the city of Zurich'' [9] is particularly significant, whose vision is to enable and test new solutions for attractive, resource-sparing, and space-efficient transportation solutions for all, including both passenger and freight transportation. In this Strategy one of the key goals is to reduce the number of private cars. One of the solutions applied in this direction is limiting the number of parking spaces, as well as restricting access to the city center for private cars. Particularly important are SM solutions based on the principle of "sharing instead of owning", strengthening public transport, multimodality, digital booking platforms and automated driving, which are implemented by applying a series of smart solutions that encourage transport in a way that has as little negative impact on the environment as possible and with the lowest possible energy consumption. In the function of limiting the access of private cars to the city center and increasing urban mobility the following solutions are implemented: "Transit priority program (TPT)", smart traffic signals, Multimodal Mobility Platform "ZüriMobil", "drive on-demand" ,,VBZ Pikmi'' transport, as well as a number of innovative solutions in the field of micro mobility.

Zurich is a representative city with extremely well-organized public transport. It is especially important to point out that all buses that used conventional types of fuel have been replaced by trolleybuses and buses that use electricity for movement. In order to encourage the use of public transport, the frequency of traffic lines has been increased. In addition, the " TPT " was introduced, thanks to which special lanes were introduced on roads where only public transport vehicles can move (Figure 1). This program is continuously improved by introducing a

Fig. 1 *Reconstruction of the street as part of the ,,Transit priority program''* ***Fig. 2*** *Shared micromobility service*

Source: https://www.stadt-zuerich.ch/ted/de/index/taz/verkehr/mobilitaetsberatung/impuls_mobilitaet.html

a series of ICT in the following domains: equipping public transport vehicles with GPS, equipping traffic lights and streets with sensors, video surveillance and other technologies [10]. Modern signaling ensures that when the sensors detect the arrival of a public transport vehicle at the intersection, the system, if possible, turns on the green light at the traffic light before the vehicle reaches the traffic light, so that the vehicle passes the intersection without stopping. This program controls traffic volumes in the city to prevent gridlock and improve livability.

In the context of improving urban mobility and reducing the number of individual vehicles, the Multimodal Mobility Platform "ZüriMobil" is of particular importance, which enables users to access all types of public transport. After the user enters information about his location and where he wants to go, the application first offers him all possible types of transportation: bus and trolleybus transportation, micromobility solutions (electric bicycles, scooters, etc.), taxi transportation, as well as a car sharing option private vehicles [7]. In addition to the above, the application allows users to compare all alternatives in terms of length, travel time and price.

Furthermore, a novelty in public transport introduced by the city of Zurich is the shared micromobility service [11]. This concept includes dockless e-scooters, dockless and docked bikes and e-bikes (Figure 2), electric and classic bicycles for transportation in the city. The key benefit of micromobility is the creation of an alternative transportation solution that offers flexibility and is suitable for transportation over shorter distances. In Zurich, there are several companies that provide shared micromobility services, which offer several thousand bicycles, located at several hundred stations. Companies that provide rental services for these vehicles operate in two ways. The first way is that means of transport are located at "stations" and that transport is carried out from one station to another. Another way is that the means of transport do not have classic stations, but have built-in GPS so that the user can find out where the nearest means of transport is via the application. In both cases, the vehicle is started via the application on the mobile phone through the user account of each user, and in this way the service is charged. After arriving at his destination, the user leaves the means of transport with which the new user is transported. The most common shared bicycle service is ,,PubliBike'', which offers over 700 bicycles, located at around 160 stations in the city (Figure 3).

***Fig. 3** ,,PubliBike'' shared bicycle service*
Source: https://www.velojournal.ch/aktuell/nachrichten/detail/publibike-bleibt-in-zuerich/

Micromobility, transportation by electric scooters and bicycles has significant advantages compared to classic public transportation. One of the advantages is

that there is almost always available means of transport nearby. In addition, the movement is carried out outside the standard routes, that is, it is adapted to the needs of users, so that users are transported from the initial to the final destination in the shortest time. On top of all that, the means of propulsion use electricity, which is currently the most environmentally friendly or human power. According to current data, there are a total of 740 km of streets and roads in Zurich, while the length of bicycle paths is 340 km [7]. Bicycle paths are often built along the streets or occupy the right edge of the roadway, but in such a way that automobile and bicycle traffic do not cross. At the intersections of the streets priority is given to bicycle traffic or there are traffic lights, so that the traffic flows efficiently, without mutual disturbance of the traffic participants. The length of bicycle paths as well as the construction method significantly affect the efficiency of traffic flow and increase the attractiveness of using micromobility means. The key factor for the implementation of the micromobility concept in Zurich is a well-developed e-bike infrastructure that makes it easy and safe to cycle throughout the city. The following five basic modes of E-bike infrastructure are represented: bike lanes, bike paths, bike parking, bike sharing, bike-friendly streets (Figure 4).

Bike lanes
Source: https://www.stadt-zuerich.ch/site/velo/de/index/bericht-velofoerderung-velosicherheit.htmls

Bike paths
Source: https://cyclingchristchurch.co.nz/2015/08/09/cycling-in-zurich-an-uphill-challenge/

Bike Parking
Source: https://www.meyer-hayoz.com/en/project/v-locker/ng

Bike Sharing
Source: https://joydellavita.com/publibike-public-bike-sharing-zurich/

Bike-friendly Streets
Source: *https://ethz.ch/en/news-and-events/eth-news/news/2023/11/how-zurich-has-to-change-its-roads-to-have-more-e-bikes-than-cars.html*

Fig. 4 *E-bike infrastructure in Zurich*

3. CONCLUSION

In this paper the concept of SM was examined in Zurich, which is a representative example of a city that prioritizes smart mobility solutions. The paper discusses numerous SM solutions implemented in Zurich, which all work strategically toward

numerous of challenges that this city faces, and which are also represented in other cities around the world. Key SM solutions that are in Zurich are: "Transit priority program", smart traffic signaling, Multimodal Mobility Platform "ZüriMobil", transportation "on demand" ,,VBZ Pikmi'', numerous innovative solutions in the field of micromobility, well-developed e-bike infrastructure as well as promotion of walking and cycling. This study reveals that the integrated application of the mentioned SM solutions in Zurich contributes to increasing the urban mobility, reducing the number of private cars, introducing innovative transport solutions, improving traffic safety and reducing air pollution, i.e. achieving multiple benefits, which ultimately leads to a better citizen's quality of life and sustainable development. It can be concluded that the SM solutions implemented in Zurich can be of great importance for other cities to design their own path in the field of dealing with current challenges as well as in improving the quality of life.

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