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Smart road infrastructure: Shaping the future of Shengjin accessibility.

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Abstract- *Albania is a strategic area in terms of tourism, because of its unspoiled beaches, cultural heritage, mountainous landscapes, connection with other countries, etc. Tourists suffer from the lack of smart infrastructure in Albania, which makes them face with traffic congestion during summer, in road segments towards beach areas. Lezha region is one of these Albanian attractions, among others, famous for the Shengjinbeach. Visiting it in summer is a real challenge, because of traffic congestion caused by insufficient road infrastructure, influx of visitors, lack of signaling, etc(Ora News, 2022). As long as, this concentration of tourism during the summer is associated with many natural, economic and social consequences, the issue of infrastructure should be addressed and improved. The improvement of physical infrastructure is an important and valuable tool related to the development of tourism(Lee et al, 2020). The chosen area for intervention is the segment from Shengjin to the main intersection at the entrance, which is considered also as 'point of death'. Nowadays, technology facilitates our lives in many directions(Javaid et al, 2018), thanks to its unlimited components and it can be applied as well in road infrastructure.This paper aims to achieve these goals by using internet of things technology and different types of sensors based on it (speed sensors, IP CCTV cameras, smart traffic lights, digital signage, etc). Applying technology in this segment, provides an enhancement of Shengjin accessibility and developing more sustainable tourism in this area, contributing also to the reduction of accidents. In this way, we increase the efficiency of existing roads and improve their maintenance. Despite suggesting other mobility alternatives our proposal will convert the existing infrastructure into a better one, providing in this way a higher quality of tourism in this area and encouraging visitors to access Shengjin more often.*

Key words: Smart infrastructure, traffic congestion, internet of things, sensors, accessibility

1. Introduction- Defining information technology as a necessity and inevitably part of the shaping and sustainable development of future cities, makes us move from the macro level of thinking about what the city of dreams should look like in the future, to the micro level of sustainable and secure development based on the basic components of shaping a city such as infrastructure, services and land and further on the subdomain cells of each component (domain) in the function of the body (smart city). The development of the overall concept of sustainable interdependent development for the city as a basic definition has enabled us to no longer focus only on what we perceive as the digital city of everyday life, but to move forward towards parallel approaches to the cities representing the conception of tourist, industrial, historical city etc.

The concept of an intelligent tourist city in its entirety has social, economic and cultural aspects from where technology has the main role in convergence towards the creation of what is called a smart

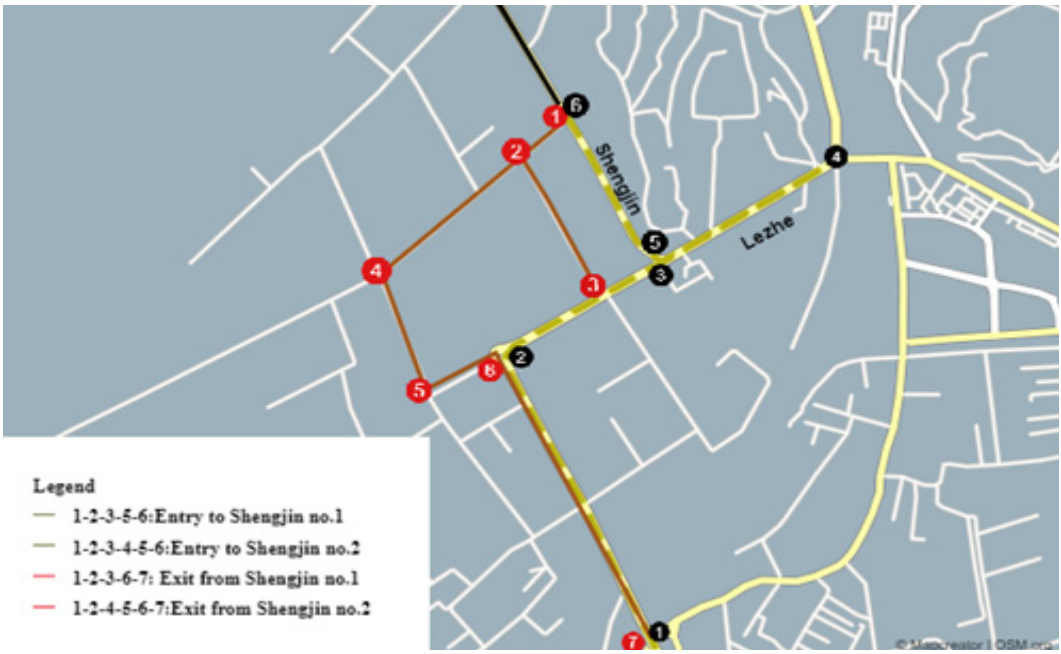

Fig. 1 / Proposed scenarios in the Shengjin-Lezha segment (source:https://www.openstreetmap.org).

touristic city. The city infrastructure itself as the artery of its development relies on its development based on the so-called smart mobility(Jaya et al, 2019).

Lezha is an Albanian city, positioned in the north of the country. It is known for its favourable geographical position, rich history and its tourism potential. Being an infrastructural connection between Kosovo and Montenegro, and having one of the most relevant natural reserves such as Kune Vain make Lezha a strategic area in terms of tourism development. Last, but not least, the recent development of Shengjjin, as one of the crucial seaside tourist destinations in Albania, is an added value to the region. Nevertheless, nowadays tourism in this region is concentrated only during summer and focuses mostly on the seaside and this creates several consequences on the economic, natural and social levels.

In Shengjin, within a coastline of 13 km, the social, economic and historical elements of a classic touristic city are intertwined where technology is not yet present to converge the vital and developmental components of a city and as a consequence, the opportunity to see the city of the future is far away. Nowadays, Shengjin as a tourist city is faced with an increasing number of tourists mainly from Kosovo, and further domestic and foreign tourists (in 2014 during the tourist season the number of people with a daily average reached 40 thousand people).

From the point of view of infrastructural development and the problems that arise from this level of development, Shengjin suffers from heavy traffic which necessarily affects the social aspect (stress and fatigue at the time when people intend to rest), as well as health (pollution caused from the emission of CO2 from) and economic (cost of fuel and cost of time) which are ultimately defined by the negative perception of the city due to lack of movement management.

Although the road that enables the classification of Shengjin as a SmartCity is long and difficult, smart mobility as part of the basic and substantive component of the city of the future (infrastructure) can be implemented more quickly and encourage the development of other components in function of what Shengjin tends to be 'smart tourist city'.

2. Smart Road Technology

2.1 Related work

Nowadays, technology is penetrating many fields of our lives, so also urban mobility is no exception(Vrio, 2022). The application of technology on the roads is called the 'smart road'. It means the use of IoT (Internet of Things)(Jaya et al, 2019), sensors (speed, pollution), IP CCTV cameras, smart traffic lights, etc, in order to increase the efficiency of CCTV existing roads and lead to an improved traffic situation(Javaid et al, 2018). A combination of these 'tech tools' in our analyzed segment from Shengjin to the main intersection in the entrance, will enhance the accessibility developing in this way more sustainable tourism and reduction of accidents in this area. In a few words, we aim to find a smart solution for this bottleneck.

Fig 1.2 Proposed scenarios in the Shengjin-Lezha segment . Source / Autor

Although the traffic generated at the entrance of the road leading to Shengjin is perceived to occur due to the so-called 'the only access road in the area, through a smart signalling system and a real-time data management system we can switch from bottleneck situation, in the situation of traffic distribution on existing alternative, roads but not used for congestion management, especially during the tourist season.

2.2 Simulation work for Shengjin point.

The magnetic sensors placed at points 1(black/S_1), 4 (black/S_4) and 6(red/S_6) will give us a clear real-time picture of the traffic situation in this segment with a focus on the flow towards the level of congestion in the Shengjin segment. These sensors provide vehicle count, occupancy, and speed information. Vertical traffic lights will be placed at points 2(red)and 3(black) in order to orient the flow depending on the real-time data generated from both sensors. Both proposed scenarios are illustrated through algorithms below:

Short path scenario (algorithm):

If S_4 detects no heavy traffic (from Lezha to Shengjin direction)

And

If S_1 detects no heavy traffic (at the entrance)

Then

Traffic_light_3 activates short entrance path (1-2-3-5-6) and traffic_light_2 activates short exit path (1-2-3) else

Long path scenario (algorithm):

Traffic_light_3 activates long entrance path (1-2-3-4-5-6) andtraffic_light_2 activates long exit path (1-2-4-5-6-7)

In a few words, the data generated in time units will enable us to react in real-time in the direction of the transition from the centralized organization Shengjin access through point 5, to the flow transition at level 1-2-3 and simultaneously to 1-2-3-4. This orientation will be done through a vertical signal connected to the traffic management system that receives signals from magnetic sensors.

The transition from a level of mobility interruption (T or 3-5) to the mobility level (U or 3-4-5), not only does not create congestion and interruption at point T but allows creating a natural flow and saves not only time but also at the same time gives opportunities for reduction of pollution and stress through the use of data collected by magnetic sensors and their management to give the right signals to the vertical signage.

The analyzed segment must be operated through the bicycle chain model (roundabouts 2 & 4) as the entrance model to the Shengjin and the snake model for the exit from the Shengjin at the traffic peak, which coincides with the tourist season, where R_2 gear plays the role of 'slide' to the normal traffic flow, for both those coming from the main interurban road and those returning from Shengjin, avoiding unnecessary interruptions.

3. Conclusions and discussions.

The application of the proposed scenarios above during the tourism season will make Shengjin take a breath, providing a higher quality of tourism and attracting more visitors to access its beaches. The main