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International Symposium on Innovative and Interdisciplinary Applications of Advanced Technologies



Crowdsourcing approach for producing noise maps using smartphones

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June 1st – 4th, 2023 - Tuzla, Bosnia and Herzegovina

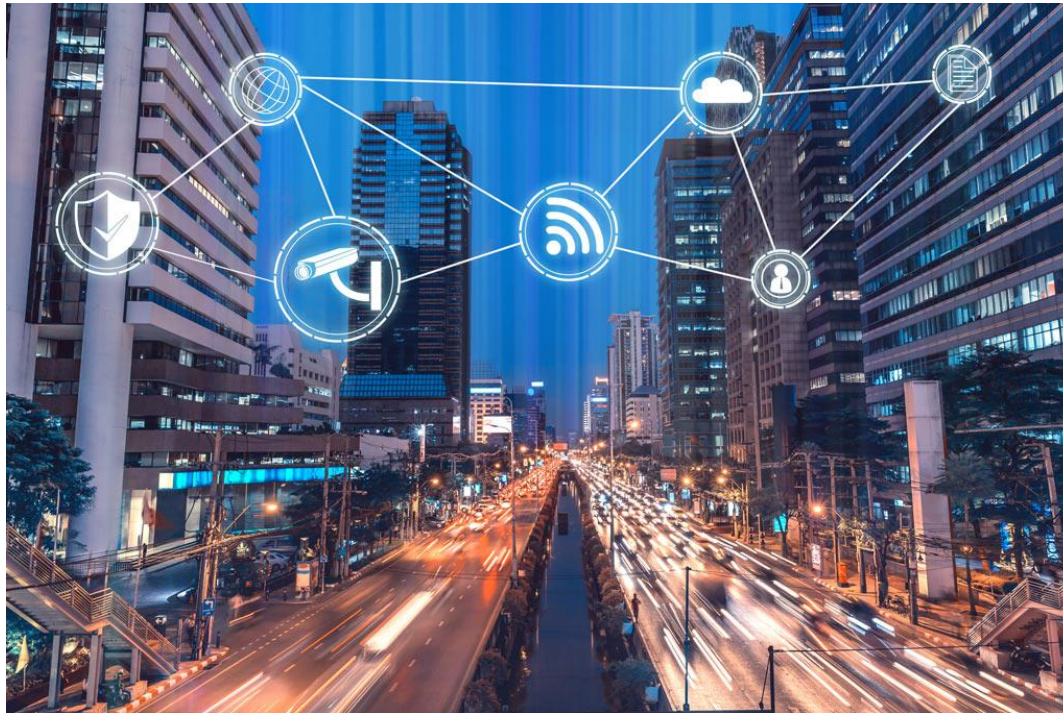


What Is Crowdsourcing?

- Crowdsourcing is an outsourcing process that is traditionally performed by employees and transferred to an undefined group of people in the form of an open call (Howe, 2006)
- Voluntary collection of information about space or the situation in space through citizens represents a significant step forward in the design of management systems and enables the elimination of certain weaknesses of the concept of smart cities.



What is Smart City?



Smart city use digital technology and data to solve a range of problem associate with urban living such as population density, air and weather pollution, waste disposal, energy inefficiency, traffic, and crime.

What is Smart Citizen?



A digitally literate person that takes advantage of technology in order to engage in a Smart City environment, address local issues and take part in decision-making.



„Smartphones are part of our daily life now. They're always with us, always on, always connected. They're incredibly powerful tools that have changed the way we interact with the world around us." - Elon Musk.

Problem formulation



Noise is unwanted sound that affects human health.

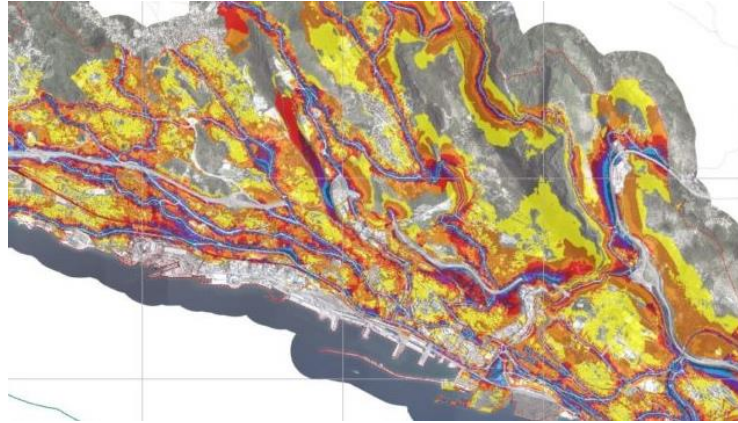


Noise maps

Noise maps are representations of the current and anticipated level of noise emissions at all sites within the study area depending on one particular or all sources of noise.

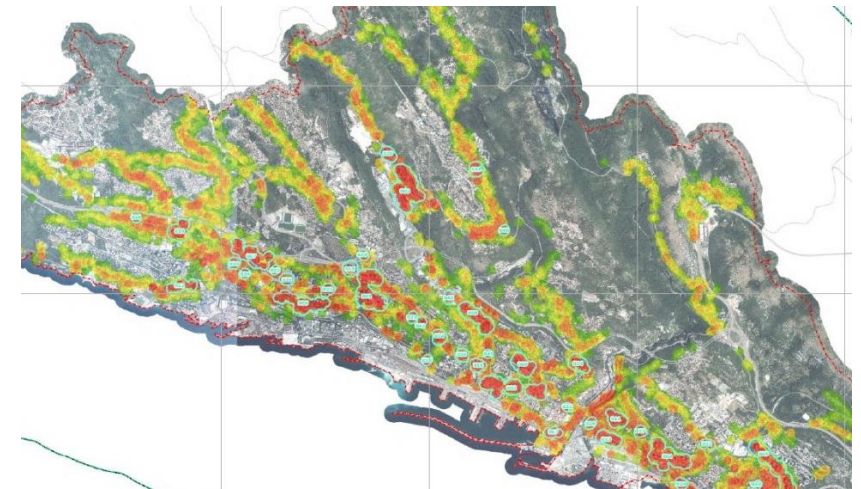
Law on Noise Protection (Official Gazette 30/09, 55/13, 153/13, 41/06 and 114/18, 14/21) and the Ordinance on the method of preparation and content of noise maps and action plans as well as the methods of calculating permissible noise indicators (Official Gazette 75/09, 60/16 and 117/18).

- 1. Strategic noise maps**
- 2. Action plans**

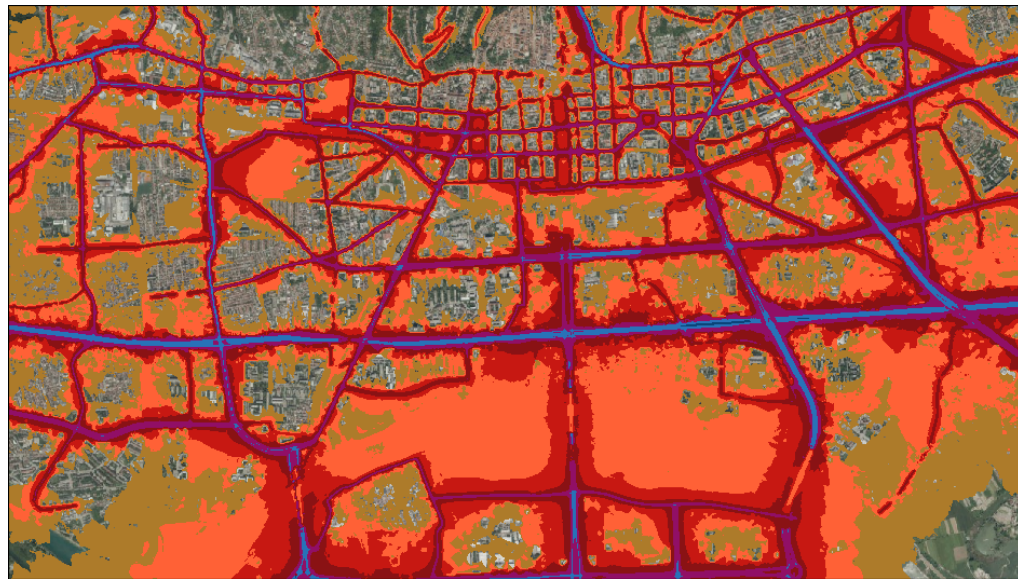


Strategic noise maps - evaluates the population's exposure to traffic and industry noise and are made individually for road, rail, air traffic and industry, including associated infrastructure and facilities for sports and recreation, and especially facilities and areas particularly sensitive to noise (hospitals, schools, kindergartens, quiet areas, etc.).

Action plans are made based on the results of the strategic noise map and the so-called conflicting noise maps, from which the **difference between the existing or predicted state of noise immission and permitted noise levels is visible.**



Strategic noise maps and action plans are an **integral part of the environmental protection information system** of the Republic of Croatia and form an expert basis for the creation of spatial plans and in the process of strategic assessment of the impact of plans and programs on the environment.



Zagreb Road traffic Noise Map (day)



Zagreb Road traffic Noise Map (night)



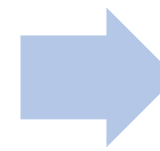
Crowdsourcing Noise Map workflow

Crowdsourcing is an outsourcing process that is traditionally performed by employees and transferred to an undefined group of people in the form of an open call (Howe, 2006)

Mobile phones as sound measuring device



Citizens measures noise exposure in their environment

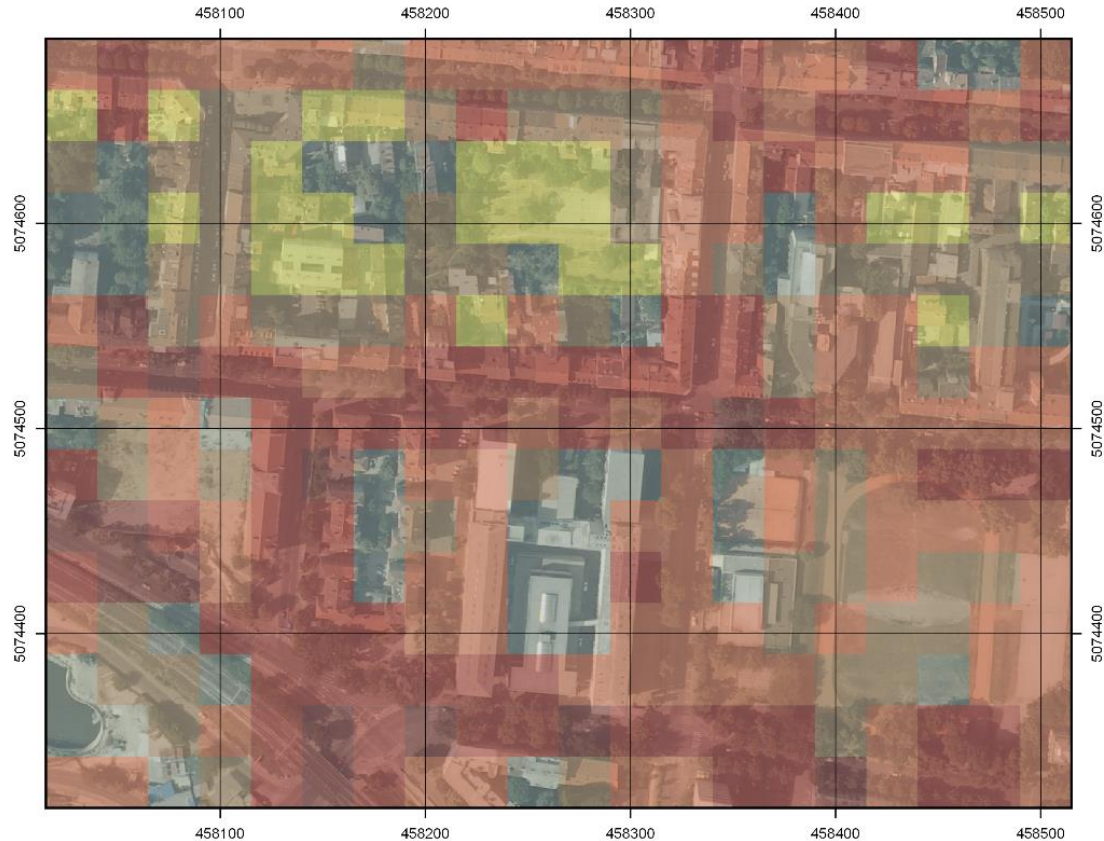


Participation of citizens in controlling noise pollution





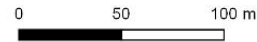
Karta buke dijela grada Zagreba



TUMAČ ZNAKOVA
Prosječna razina buke [db(A)]

- < 45
- 45-50
- 50-55
- 55-60
- > 60
- Bez podataka

M 1 : 2500



Projekcija: HTRS96/TM

Prikaz na karti odgovara stanju iz listopada 2018. godine.

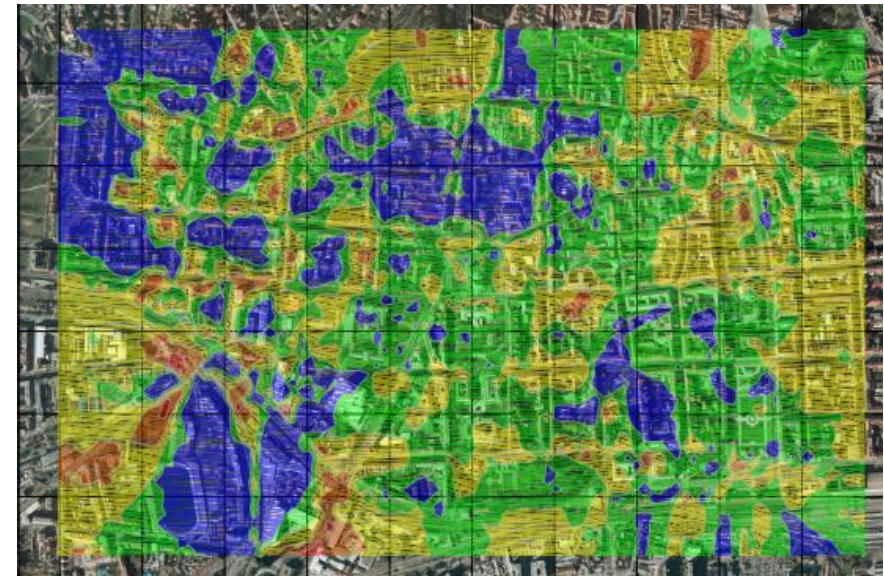
Podaci su prikupljeni NoiseTube aplikacijom, a karta je izrađena pomoću QGIS softvera.

Izradio: Marin Durđov
Izrađeno na vježbama iz kolegija "Geovizualizacija"
Geodetski fakultet Zagreb
Ak. god. 2018./2019.



Example of a view created in ArcGIS Online

Example of a view created in QGIS



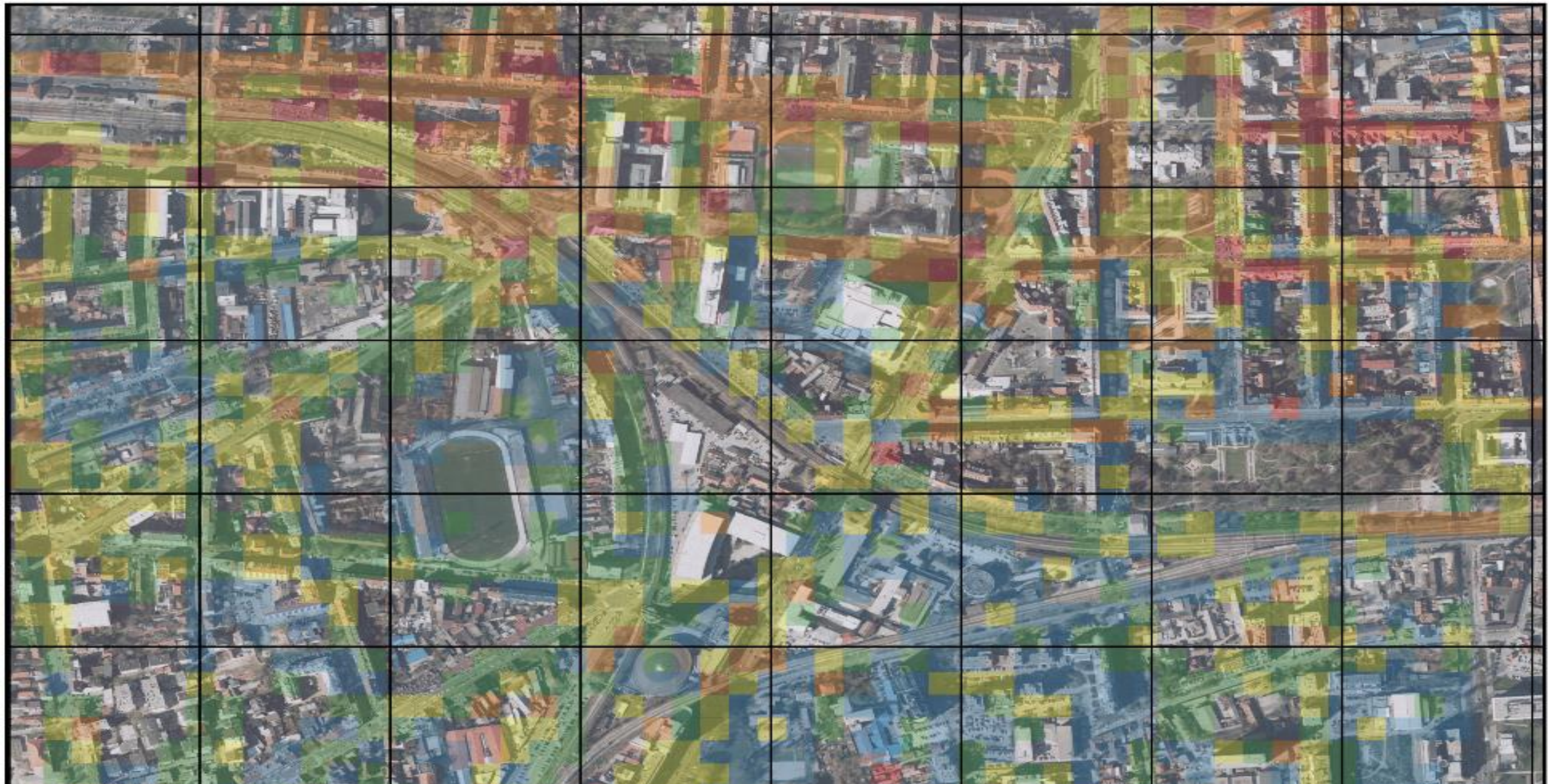
Example of a view created in Surfer



Example 1: Noise map of part of the city of Zagreb

This task is part of curriculum for mandatory subject of Geovisualization in third semester of Geoinformatics Master students.

- Each student should collect about 10,000 measurements for his area.
- Measurements must be collected in two different time intervals (eg measure in the morning from 8 to 10 am, in the afternoon from 4 to 6 pm).
- Create two views (for morning measurements and for afternoon measurements).



Noise map of part of the city of Zagreb for the period from 8 a.m. to 12 p.m



Noise map of the part of the city of Zagreb for the period from 13:00 to 17:00



Noise map of the part of the city of Zagreb for the period from 18:00 to 22:00

Example 2:



Comparative Analysis: Alexandria, Egypt vs. Zagreb, Croatia

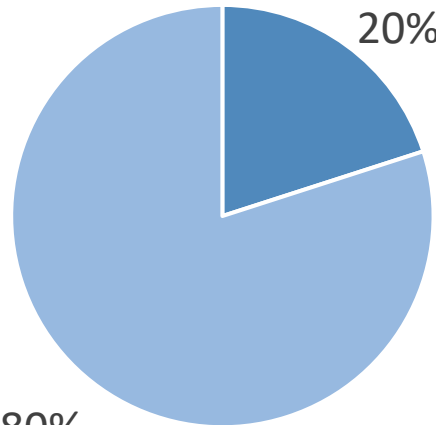
Noise Map Workshop 2023 (Alexandria, March 2023 and Zagreb April 2023)

Field measurements and analysis were performed by Esrra Othman, Alexandria University, Egypt, Iva Cibilić, Faculty of Geodesy



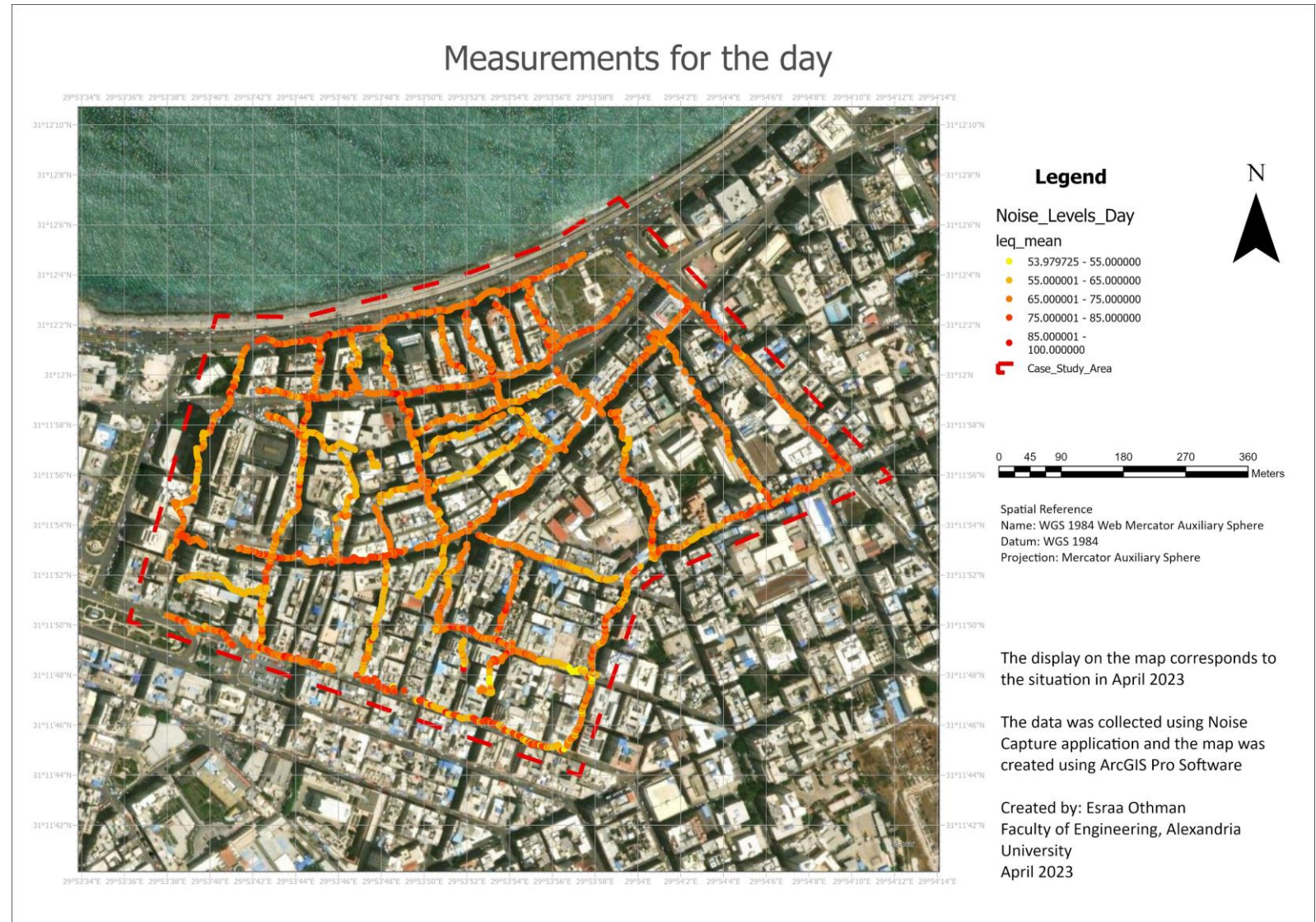
April Research Findings in Alexandria

% within legal limits

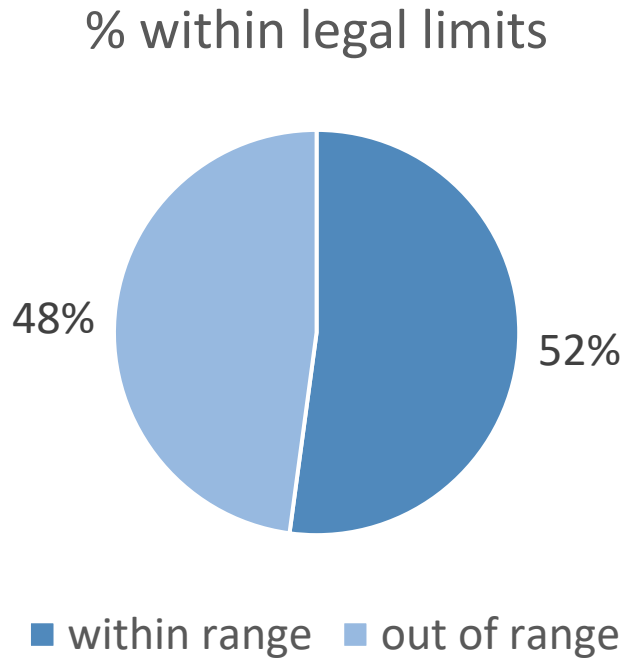


■ within range ■ out of range

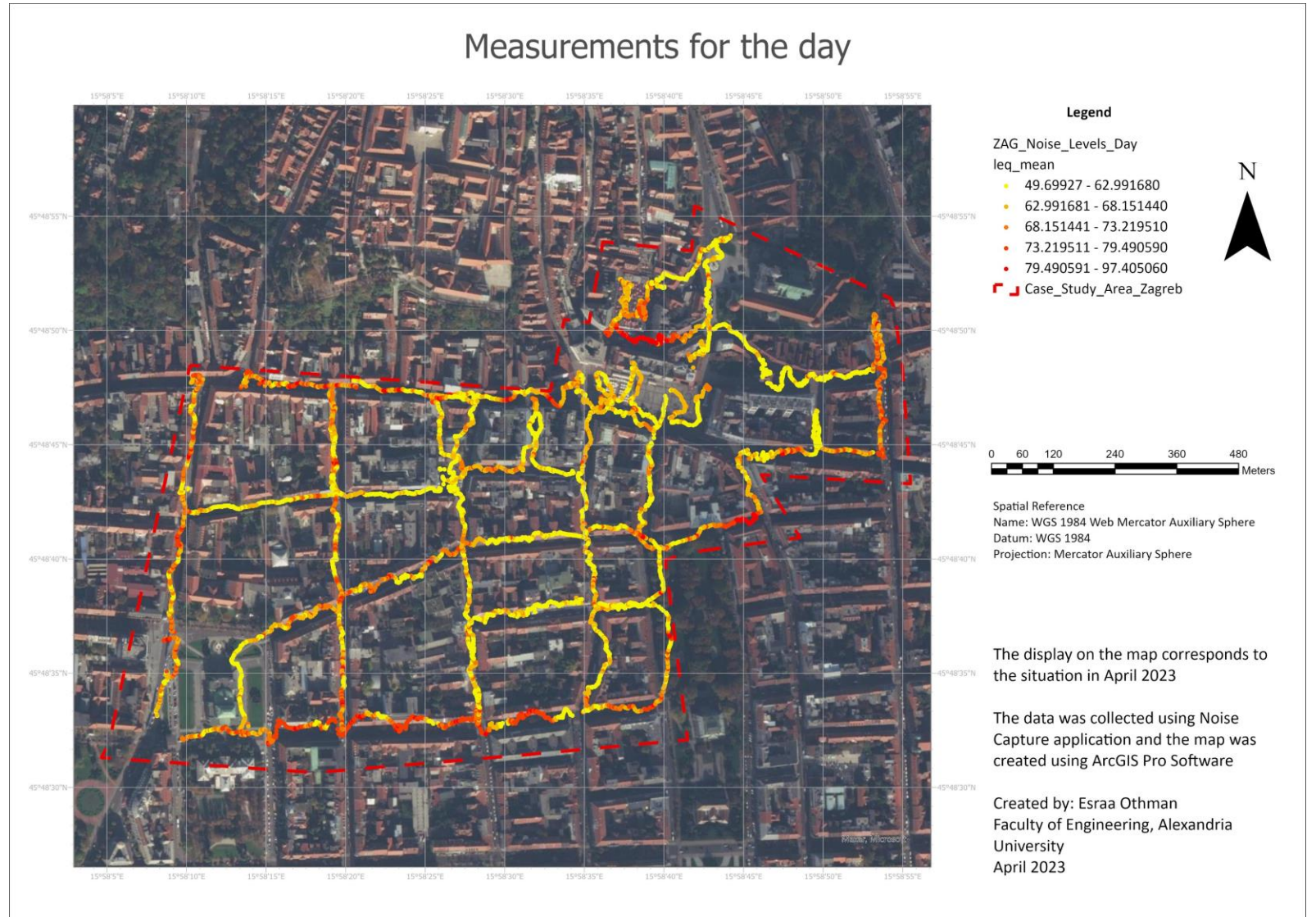
Ranges differ in categories while 20% lies within the permissible range

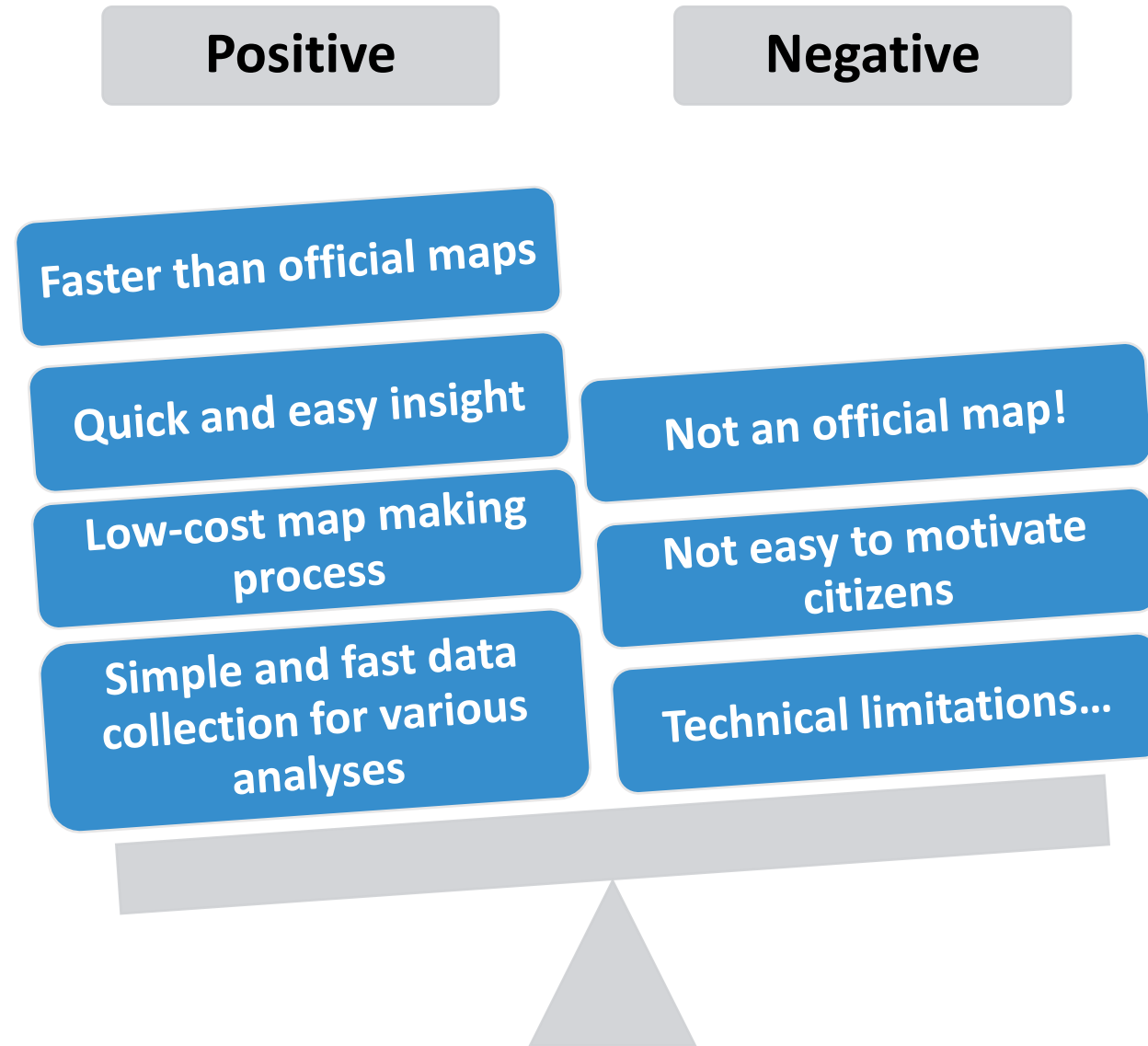


April Research Findings in Zagreb



Ranges differ in categories while 52% lies within the permissible range





Conclusion

The described noise map was made **by open-source application** for the noise measurement,, and on the mobile device. **an open-source programme for data processing**

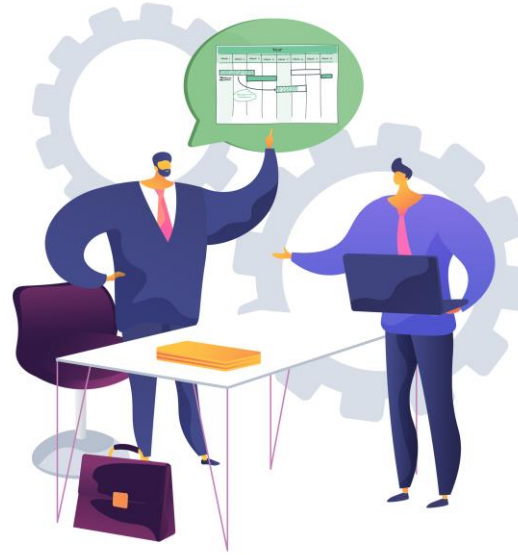
The greatest advantage of the described model:

- obtained presentation offers a **real and comprehensive illustration** of the noise pollution in the area (with the reference to all noise sources),
- map can be made **by engaging the community**, when necessary,
- simply **making general conclusions** about the noise in the environment and
- can indicate **newly created environmental noise pollution**.



Citizens and Communities concerned with noise

Local governments / city planners



Researchers



NGO







Thank you for your attention!

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<https://bhaaas.org>

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Reference (1)

[NoiseTube: Citizen Noise Pollution Monitoring](#)

[NoiseTube publikacije](#)

[Voluntary Noise Mapping for Smart City](#)

[With the Crowdsourced Spatial Data Collection to Dynamic Noise Map of the City of Zagreb](#)

[Crowdsourcing Application in the Development of a Dynamic Noise Map](#)

[Hajtića I.: Dinamička karta buke Grada Bjelovara](#)

[Njegovan A.: Analiza slobodnih aplikacija za mjerenje buke](#)

[Dželalija: Dinamička karta buke dijela grada Zagreba](#)

[Master Thesis: Collaborative noise measurement by Hugo Krier](#)

[What you need to know about Digital learning and transformation of education](#)