



WORKING GROUP NOISE EUROCITIES, ZAGREB, 11-12 MAY 2017

# Voluntary noise mapping for smart city



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## Faculty of Geodesy - University of Zagreb (1/2)

**Bachelor study program of Geodesy and Geoinformatics:** 180 ECTS and acquire the vocational degree of Bachelor (baccalaureus) of Engineering in Geodesy and Geoinformatics.



**Master study program of Geodesy and Geoinformatics:** 120 ECTS points and acquire the vocational degree of Master of Engineering in Geodesy and Geoinformatics.

**Postgraduate – Specialist study**

**Postgraduate – Doctoral study**

550 students / 100 employees / 60 teachers



## Faculty of Geodesy - University of Zagreb (2/2)

### Structure of the Faculty of Geodesy:

- Institute of Geomatics
- Institute of Cartography and Photogrammetry
- Institute of Applied Geodesy
- Observatory Hvar
- Administration

### Institute of Cartography and Photogrammetry

- Chair of Photogrammetry and Remote Sensing
- Chair of Geoinformation
- **Chair of Cartography**  
(Cartography, Thematic Cartography, Geovisualisation, ...)



## SMART CITY & SMART PEOPLE

... citizens actively participate in the realization of smart cities, both through participation in decision-making processes and, more specifically, in gathering various information needed to create a base, the starting data sets.

... smartphones have taken crowdsourcing to a new level

... include many built-in sensors such as camera, GPS receiver, microphone, proximity detecting sensor, compass, accelerometer, gyroscope etc.



## NOISE & ENVIRONMENT

*Noise is defined as any unwanted sound in the environment where people live and work, causing an uncomfortable feeling and can adversely affect health.*

... The main sources of noise in outdoors are traffic, constructional and public work, industry, recreation, sport and entertainment.

... 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.

... Noise control act (NN 20/03)



## i-SCOPE Project

### interoperable Smart City services through an Open Platform for urban Ecosystem

Objective of the project: to develop and to test technology for smart city services with the use of specially designed web platform based on open 3D Urban Information Model (UIM).

The i-Scope project creates an infrastructure that will demonstrate how these models can integrate spatial data from a wide variety of sources to developed tools for analysis, visualization and stimulation.

iSCOPE project includes: **Zagreb, Zadar**, Vienna, Lazio, Inđija, Trident, Malta, Newcastle and Baia Mare  
36 months (it was completed in July 2015) // 4.040.000 € //

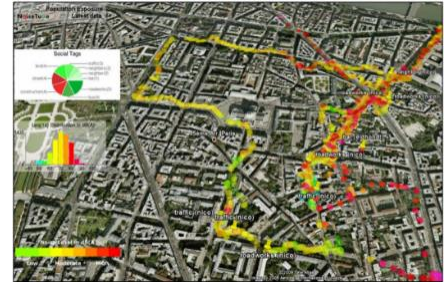
<http://iscope.graphitech-projects.com>





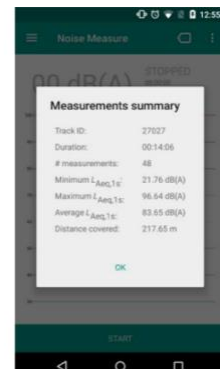
## i-SCOPE Project - components

- 1. Assessment of solar energy potential service**  
optimization of energy consumption through a service for accurate assessment of solar energy loss at building level
- 2. Personal routing service**  
improved inclusion and personal mobility of aging and diversely able citizens through an accurate personal routing service
- 3. Real time noise monitoring service**  
environmental monitoring through a real-time environmental noise mapping service involving citizens who act as distributed sensors measuring noise levels through their mobile phones



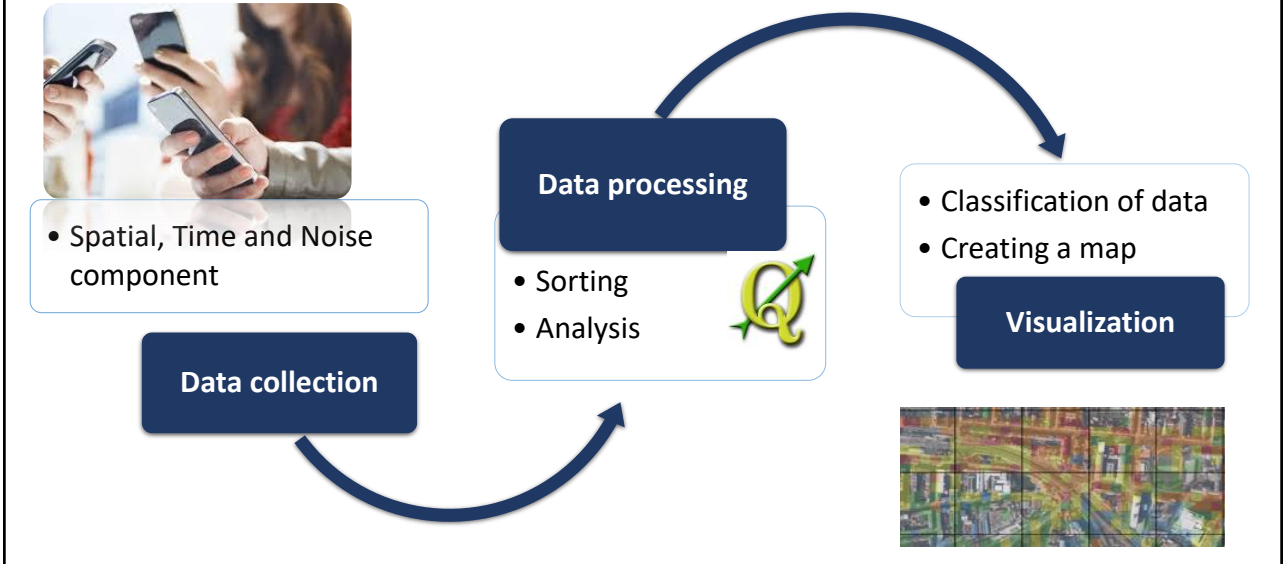
## NOISE TUBE

- ... research project started in 2008 at Sony Computer Science Lab in Paris
- ... app that turns your mobile phones into sound sensors
- ... citizens measures noise exposure in their environment
- ... participation of citizens in controlling noise pollution
- ... [www.noisetube.net](http://www.noisetube.net)

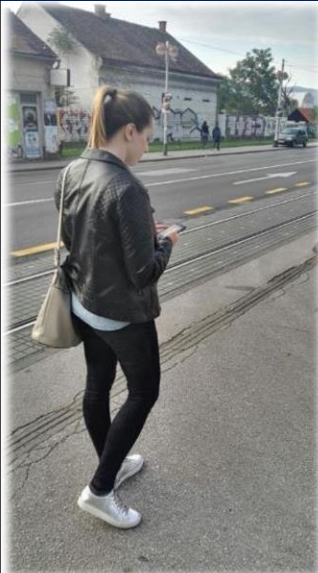


*Measuring interface and measurements summary view on Noise tube*

## VOLUNTARY MEASUREMENTS BY THE STUDENTS OF THE FACULTY OF GEODESY OF THE UNIVERSITY OF ZAGREB



## VOLUNTARY NOISE MAPPING - DATA COLLECTION



Measurements were performed during the day (7 a.m. and 22 p.m.) in the center of Zagreb.

Average student contributed with around 4000 measurements (2 to 3 hours).

Upon completed measurement, the data is automatically sent to the Noise Tube web site, from where can be downloaded in .kml format, and used in any .kml file supporting software.



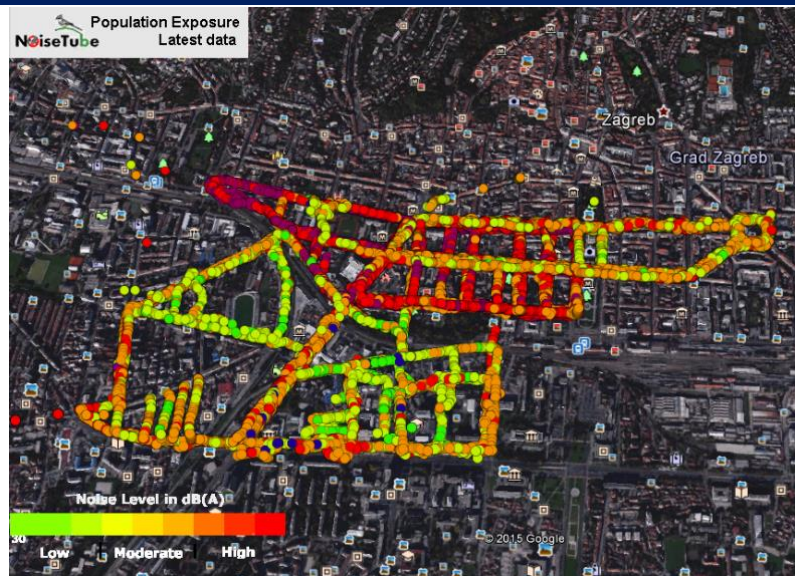
## VOLUNTARY NOISE MAPPING - DATA COLLECTION

- ✓ October-November 2016.
- ✓ Nice and sunny weather (without the influence of additional noise caused by bad weather)
- ✓ in the frame of the exercise of Geovisualisation
- ✓ 52 students with their smart phones
- ✓ Total: **192 892** data of noise levels



Time of Day:	Number of measurements	Max. value (dB)	Min. value (dB)
7-12	71594	129,73 / B4	20,039 / C2
13-17	79011	129,53 / C4	20,094 / C2
18-22	42287	87,23 / C1	20,025 / C1

## VOLUNTARY NOISE MAPPING - DATA COLLECTION



*The original measurements displayed in Google Earth*

192 892 measurements

The measured noise level is in the range  
**from 20 dB to 130 dB.**



## VOLUNTARY NOISE MAPPING - DATA PROCESSING AND ANALYSIS



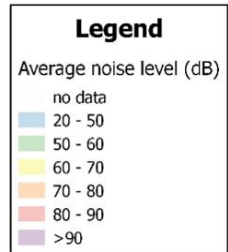
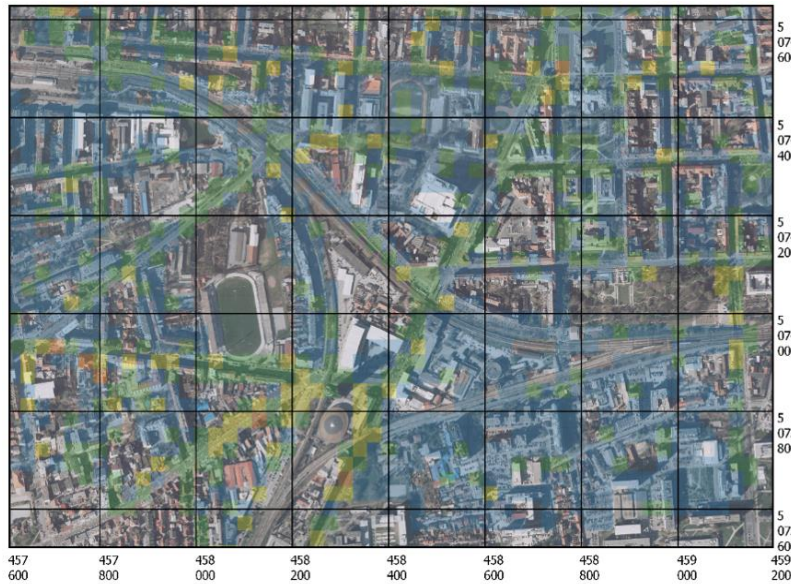
*Classified measurements displayed in QGIS (blue and green dots represents lowest noise levels, red and purple the highest)*

## VOLUNTARY NOISE MAPPING - DATA PROCESSING AND ANALYSIS

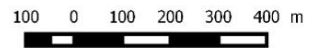


*Representation of calculated average noise level displayed in QGIS on digital orthophoto*

# The noise map of the city of Zagreb



**Mjerilo 1 : 8000**



Projekcija: HTRS96/TM

Podaci su prikupljeni Noise Tube aplikacijom.

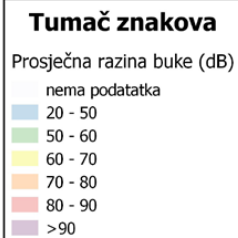
Prikaz na karti odgovara stanju 2015./2016.

Izradio: Lovro Šlabek  
Sveučilište u Zagrebu  
Geodetski fakultet  
Zagreb, ožujak 2016.

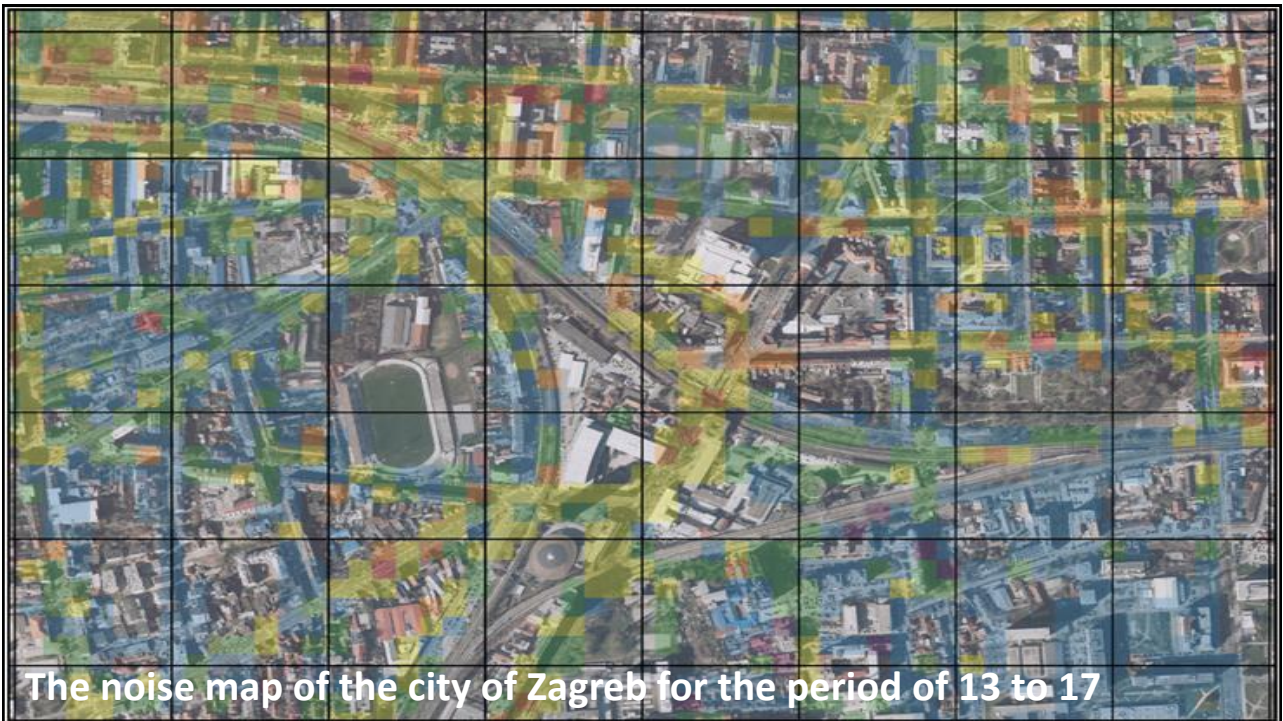
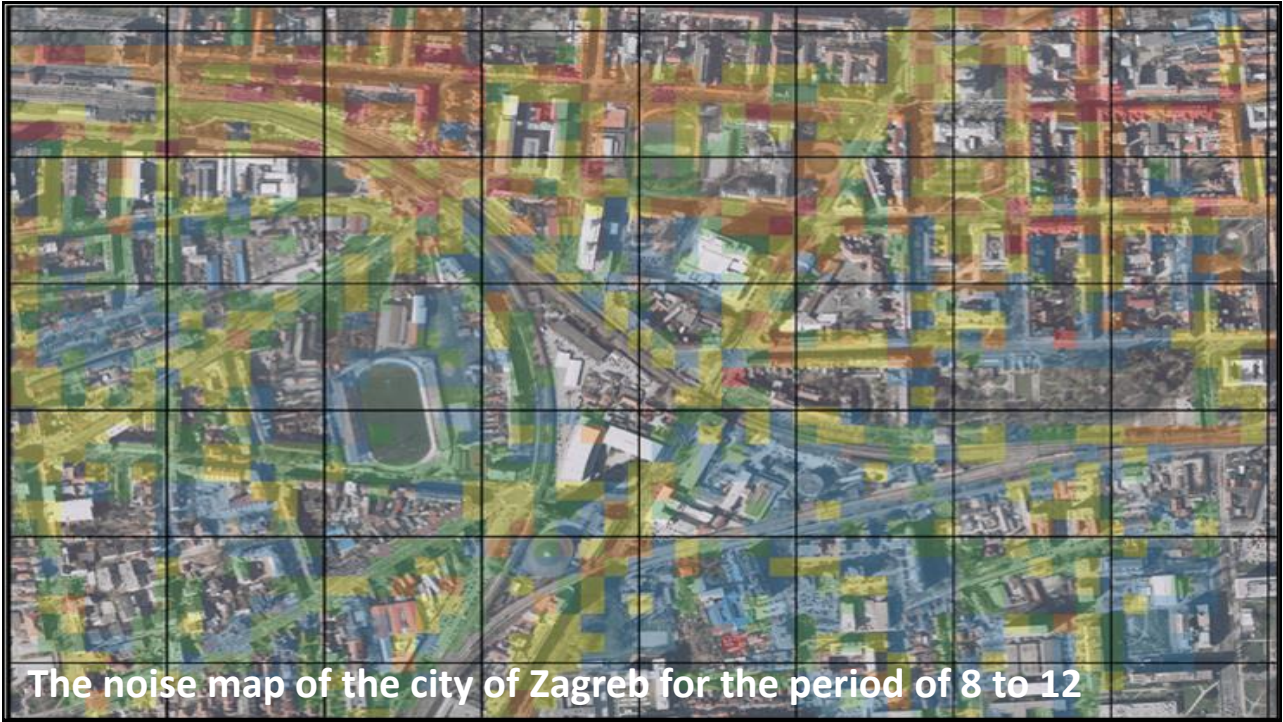
## VOLUNTARY NOISE MAPPING - DATA VISUALISATION

Given that we wanted to show a change in the noise level at certain times of day, the measurements obtained were grouped into 3 days-periods:

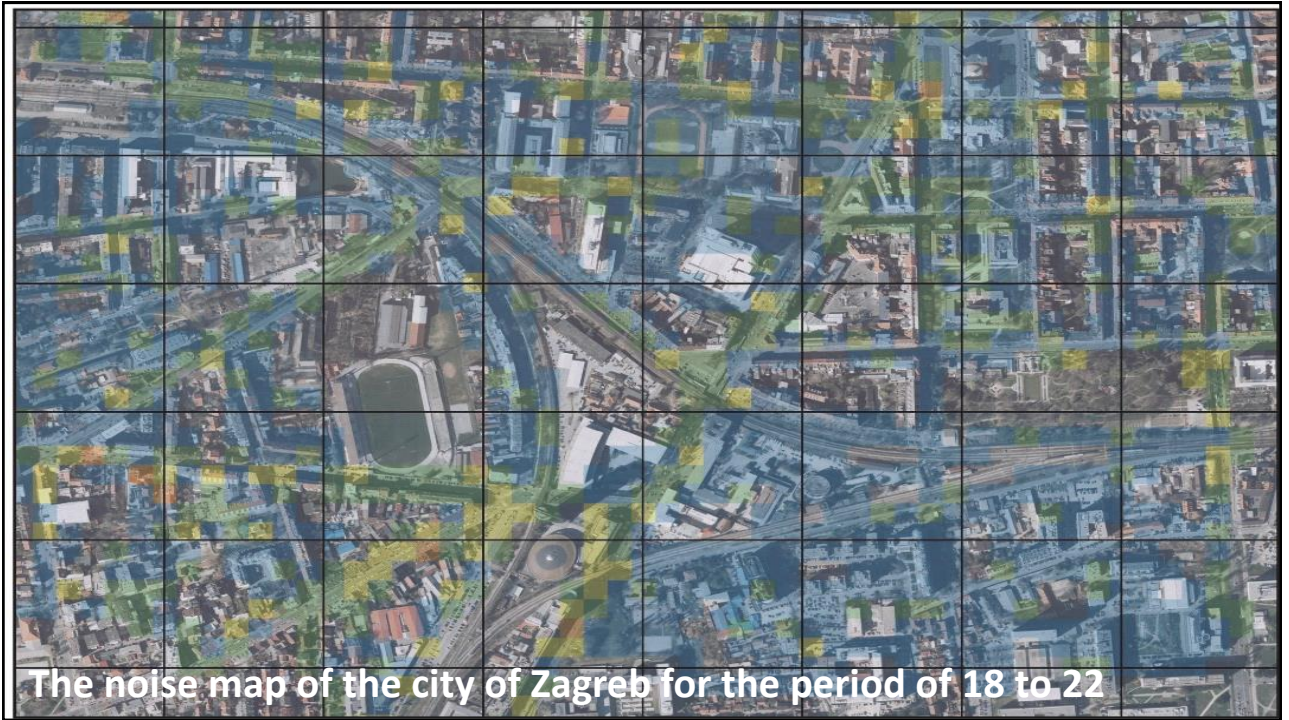
- ... Morning (7 am to 12 pm)
- ... Afternoon (13 am to 5 pm)
- ... Evening (18 pm to 22 o'clock)







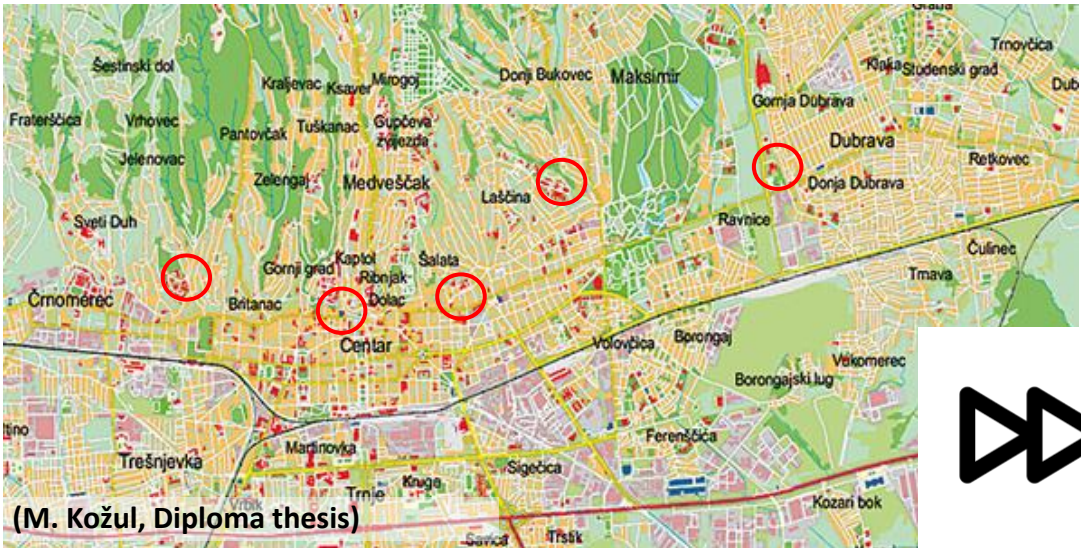




## INFLUENCE OF ZAGREB AIRPORT TO NEARBY SETTLEMENTS



## TESTING OF NOISE EXPOSURE OF HEALTH CARE INSTITUTIONS



## VOLUNTARY NOISE MAP OF THE CITY OF BJELOVAR

(I. Hajtić, Diploma thesis)

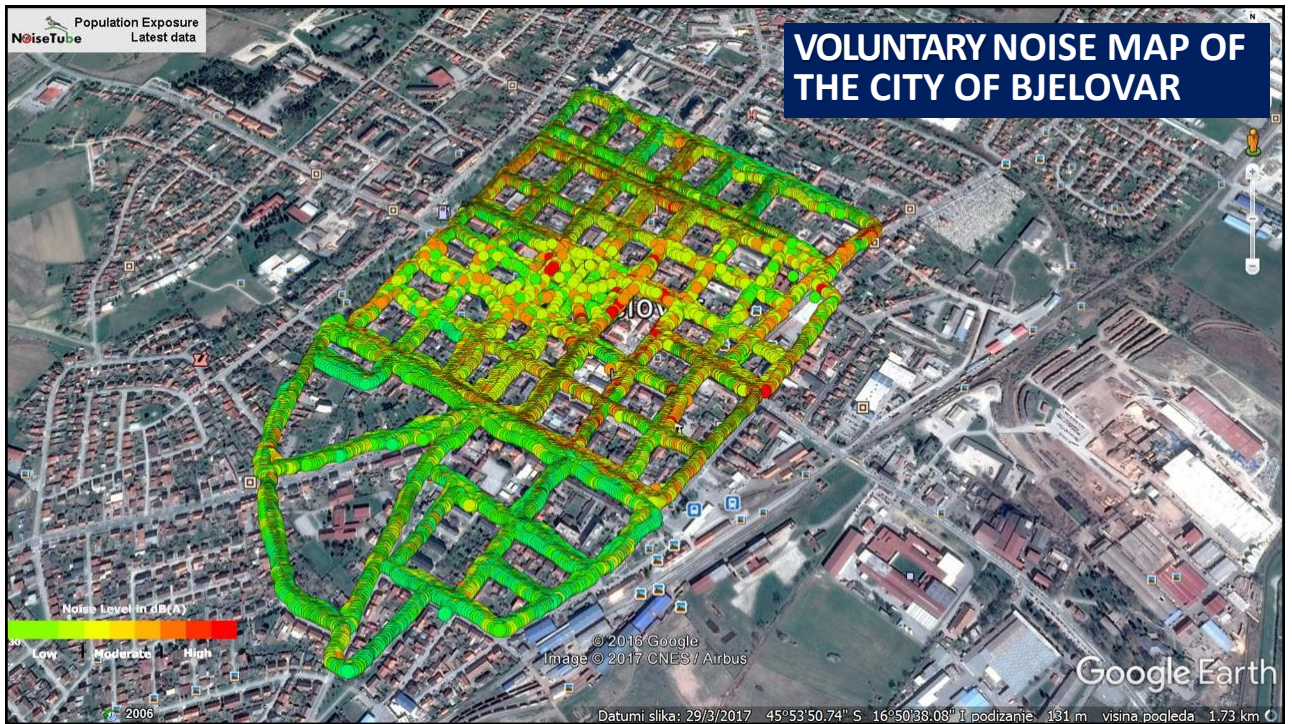
Bjelovar is a town in central Croatia, about 90 km northeast of Zagreb.

The center of Bjelovar-Bilogora County and Bjelovar-Križevci diocese.

One of the youngest cities in Croatia (founded in 1756).







## CONCLUSION

The production of noise map is possible by including the citizens into the process who act as sensors and measure the level of noise in their surroundings using the application on their mobile phone or some other smart-device.

The noise map was made by: a **free application** for the noise measurement, a **free programme for data processing** and by engaging the students who collected the data walking around the town.



## CONCLUSION

Although the voluntary noise map cannot replace the official noise maps, it can certainly point out the problems related to the noise in certain areas.

### 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*,
- ... simply making general conclusions about the noise in the environment and
- ... can indicate newly created environmental noise pollution.



**Thank you for your attention!**



doc. dr. sc. Vesna Poslončec-Petrić; [vesna.posloncec@geof.hr](mailto:vesna.posloncec@geof.hr)

## References:

Poslončec-Petrić, V.; Vuković, V.; Frangeš, S.; Bačić, Ž. (2016): [Voluntary Noise Mapping for Smart City, First International Conference on Smart Data and Smart Cities](#), September 7-9, 2016, Split, Croatia.

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Vuković, V.; Hamin, S.; Poslončec-Petrić, V.; Frangeš, S. (2015): [Voluntary Data Collection Needed for Monitoring the Noise in Real Time](#), 11, Conference on Cartography and Geoinformation, Programme and abstracts, Lapaine, M. (ed.), Croatian Cartographic Society, Zagreb, pp. 11-12.

Vuković, V.; Hamin, S.; Poslončec-Petrić, V.; Frangeš, S. (2015): [Dynamic Noise Map of the City of Zagreb Made within the Frame of i-SCOPE Project](#), 13. Festival of Science, Technical Museum, Zagreb.

Šlabek, L. (2016): [Modern technologies in securing smart cities](#), Faculty of Geodesy University of Zagreb, Graduate thesis.

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